Subject Matter Code: C-01 Mercury

Comment ID: CTR-002-007a
Comment Author: Comm. for a Better Environment
Document Type: Environmental Group
State of Origin: CA
Represented Org:
Document Date: 09/24/97
Subject Matter Code: C-01 Mercury
References:
Attachments? Y
CROSS REFERENCES

Comment: Proposed mercury criteria ignore the concentration of mercury in the food chain and site specific field data in a scientifically insupportable manner. One reason EPA's criterion allows mercury to harm Bay fishing, as shown above, is that EPA's proposed "bioconcentration factor" predicts that I part per trillion (ppt) of mercury in water results in 7,374 ppt in fish eaten by the public. EPA rejected "bioaccumulation factors" from the Great Lakes which-predict that the same I ppt in water results in 27,900 to 140,000 ppt mercury in fish eaten by the public. This decision weakens the criterion drastically by ignoring mercury's most dangerous aquatic property.

EPA's rejection of data on mercury concentration in the aquatic food chain is scientifically insupportable. The fact that mercury concentrates strongly in aquatic food chains is beyond dispute. However, EPA's bioconcentration factor includes data on the "uptake and retention of a substance. from water only." EPA'S criterion thus fails to protect against human exposure to all mercury that gets into fish from the food the fish eat, which comprises most of this human mercury exposure. (The statement that EPA's "PBCFs take into account uptake from food as well as water" appears to mean food and water consumption by humans, and should not be read to obfuscate this problem.)

EPA's rationale for rejecting mercury bioaccumulation data for protection of San Francisco Bay is incorrect. The proposal states that. "Lacking the data, it is difficult to determine if the [bioaccumulation factors] used in the [Great Lakes Initiative] represent the potential for mercury bioaccumulation in surface waters in California." However, numerous high quality field measurements of San Francisco Bay water and fish eaten by the public demonstrate mercury bioaccumulation comparable with Great Lakes estimates and far greater than EPA'S "bioconcentration factor.(*3) (*16) These data are summarized in Table 7. It is unscientific to ignore high quality, consistent field data showing mercury concentration in aquatic food webs while proposing a criterion which allows harm to fishing.

(*3) San Francisco Estuary Institute, 1997. Regional monitoring program for trace substances 1995 annual report. Excerpts including pages 105, 3, and A-17 through A-24 showing the percentage of sediment bioassays (larval bivalve and Eohaustorius tests) that were toxic (less than 80% of control value) at RMP stations from 1991-1996, sampling stations, and dissolved and total metal, and PAH concentrations in San Francisco Bay waters.

(*16) California Regional Water Quality Control Board, San Francisco Bay Region, 1995. Contaminant levels in fish tissue from San Francisco Bay. Final draft report. Excerpt including data from toxic pollutant analyses of fish tissue samples from S.F. Bay. December, 1994.

Response to: CTR-002-007a

See response to CTR-002-007b on this issue.

Comment ID: CTR-002-007b
Comment Author: Comm. for a Better Environment
Document Type: Environmental Group
State of Origin: CA
Represented Org:
Document Date: 09/24/97
Subject Matter Code: C-01 Mercury
References:
Attachments? Y
CROSS REFERENCES

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(*16) California Regional Water Quality Control Board, San Francisco Bay Region, 1995. Contaminant levels in fish tissue from San Francisco Bay. Final draft report. Excerpt including data from toxic pollutant analyses of fish tissue samples from S.F. Bay. December, 1994.

Response to: CTR-002-007b

EPA acknowledges concerns expressed by the commentors about mercury bioaccumulation and the protectiveness of the mercury human health in the final rule. EPA is well aware of the adverse human health and environmental effects associated with mercury exposure and the role that bioaccumulation plays. Several reports have been published recently documenting EPA's concern for, and guidance on, protection from mercury exposure. These documents include: Mercury Study Report to Congress, (EPA-452/R-97-008); The National Survey of Mercury Contamination in Fish. Database Summary 1990-1995. September 29, 1997; 1995 Updates: Water Quality Criteria Documents for the Protection of Aquatic Life in Ambient Water, (EPA-820-B-96-001); and Final Water Quality Guidance for the Great Lakes System: Final Rule. Fed Register, 60(56):15366-15425 (March 23, 1995). As noted in these documents and many other publications, mercury bioaccumulation is a very complex process that is not fully understood. Methylmercury is the most toxic and readily bioaccumulated form, but mercury methylation and bioaccumulation varies from location to location due to biological, physical, and chemical factors that are not completely understood. Much additional research is need to characterize these factors so that accurate predictions of methylmercury bioaccumulation can be made. EPA is working to improve the body of knowledge on mercury bioaccumulation, toxicity, and risk management, which will lead to improved protective mercury criteria. For example, EPA's Office of Research and Development is sponsoring a multi-year, several million dollar, Science to Achieve Results (STAR) research grant program to specifically investigate the fate and transport of mercury in the aquatic environment. Grants and funding will be awarded to successful applicants beginning in 1999.

In addition to these research activities, EPA is reviewing the basis for the human health mercury criterion and is conducting a comprehensive review of its overall human health criteria methodology. In 1998, Congress directed the National Academy of Sciences (NAS) to review the toxicological basis for EPA's reference dose (RfD) for mercury. NAS will review toxicological data generated from studies conducted in the Faroe and Seychelles Islands and assess its appropriateness for use in the RfD derivation. This review is scheduled to begin in mid-1999 and be completed in July, 2000. EPA plans to update the National 304(a) criteria once the review is complete, and then subsequently update criteria for California.

EPA believes the 304(a) mercury criteria will also be improved once the recently proposed revisions to the Ambient Water Quality Criteria Derivation Methodology Human Health (EPA-822-B-98-005) are final and ready for use in deriving National recommended criteria. Proposed changes to the human health methodology affect both the reference dose derivation and exposure assessment applicable to mercury. As recommended by a number of commentors, the proposed revisions to the human health methodology would use bioaccumulation factors (BAFs) rather than bioconcentration factors (BCFs) or practical bioconcentration factors (PBCFs), to derive water quality criteria in the future. EPA has received public comment on the proposed revisions to the health methodology and held an external peer review workshop in May,1999. EPA believes that such peer review is essential to maintaining the scientific defensibility of its water quality criteria. Once the methodology is finalized based on reviewers' comments, new National recommended mercury criteria for human health and aquatic life can be derived, and then subsequently criteria for California can be updated.

Any revision to either a National or California mercury criterion will include an evaluation of all relevant bioaccumulation data. The data in the GLWQI is specific to the Great Lakes region and its applicability to California waters has not been finally determined. The GLWQI BAFs alone cannot be directly applied

to California because the biological, chemical, and physical factors that influence mercury bioaccumulation will be different in California when compared to the Great Lakes region. Examples of these factors include: foodchain interactions, physicochemical parameters (e.g. pH, temperature, dissolved and particulate organic matter), and size and type of watershed. Additionally, the GLWQI BAFs were developed for lakes only, whereas the waters affected by mercury in California include rivers and estuaries, for which very little data on the bioaccumulation potential of mercury is available. Virtually nothing is known about the applicability to rivers or estuaries of BAFs which are based on lake ecosystems. However, EPA is currently gathering bioaccumulation data on lentic (lakes), lotic (streams, rivers) and estuarine environments in order to assess the nature and extent of bioaccumulation in different water bodies and the application of BAFs across ecosystems. Although the bioaccumulation data cited by the commentors for San Francisco Bay and Clear Lake appear to be quality data, the development of any California-specific BAFs would require more than these few limited studies.

In summary, EPA agrees that mercury in the environment is a problem and has clearly documented its adverse effects to humans and ecological receptors. Regulatory controls are need to protect humans, wildlife, and aquatic life from exposure to mercury. However, there are a number of issues that must be considered and resolved before EPA can conduct a revision of the National 304 (a) mercury criteria and promulgate revised values for California. The dominant issues are:1) finalize the overall Ambient Water Quality Criteria Derivation Methodology for Human Health, 2) within the human health methodology, finalize the approach for deriving bioaccumulation factors, and 3) wait completion of the NAS review and subsequently revise the National human health criteria for mercury. For these reasons EPA is at this time promulgating mercury criteria of 0.05 ug/L (consumption of water and organisms) and 0.051 ug/L (consumption of organisms only) as proposed in the CTR, rather than promulgating revised criteria based on partially peer reviewed methodologies, evolving science, and incomplete understandings of the factors that affect mercury bioaccumulation. Once this comprehensive review is complete, the mercury criteria will be revised as appropriate, supported by scientifically defensible and peer reviewed methodologies and data.

Comment ID: CTR-003-009
Comment Author: City of Riverside
Document Type: Local Government
State of Origin: CA
Represented Org:
Document Date: 09/22/97
Subject Matter Code: C-01 Mercury
References:
Attachments? N
CROSS REFERENCES

Comment: 9) The use of a $200 and $500 per toxic pounds-equivalent as a upper end cost basis seems arbitrary. From our perspective, there is no reason to assume that an alternative regulatory approach to toxics compliance will or, where uses may have been previously obtained, can be made available to the City at no cost. Although we disagree with EPA guidance, it clearly states that a minimum of 1-2% of median household income must be spent prior to relief based on economics. Relief may be available for expenses above that level. Assuming a median disposable household income of $30,000 the ceiling would be $300 - $600 per year. Since households are now spending $156.60 a year, that means that costs could go up $143.40 - $443.40 per household before the EPA would consider it an economic hardship. For 110,000 households, that is an increase of $15,774,000 - $48,774,000 per year for the City of

Riverside alone. When performing an economic analysis the EPA should be consistent with its own guidance.

Response to: CTR-003-009

See response to CTR-032-004 and CTR-060-019 (Category E-01m; Regulatory Relief)

Comment ID: CTR-005-003c
Comment Author: Novato Sanitary District
Document Type: Sewer Authority
State of Origin: CA
Represented Org:
Document Date: 09/23/97
Subject Matter Code: C-01 Mercury
References:
Attachments? Y
CROSS REFERENCES C-22
C-24a
G-09
G-05
G-04

Comment: 2. The following provisions of the rule are supported: (1) adoption of metals criteria as dissolved concentrations; (2) expression of the metals criteria as a function of the water-effect ratio; (3) adoption of the proposed new human health criterion for mercury; and (4) the Preamble discussions regarding metals translators, mixing zones, and interim permit limits.

Response to: CTR-005-003c

EPA agrees with the comment.

Comment ID: CTR-006-001a
Comment Author: Natural Resources Defense Cncl
Document Type: Environmental Group
State of Origin: CA
Represented Org:
Document Date: 09/22/97
Subject Matter Code: C-01 Mercury
References:
Attachments? Y
CROSS REFERENCES

Comment: The Natural Resources Defense Council strongly opposes the Region 9 EPA proposal to raise the allowable mercury criterion for continuous concentration in water from 0.012 parts per billion (ppb) to 0.770 ppb for aquatic life. This proposal is difficult to justify from the point of view of science and of public health. On behalf of our over 350,000 members nationwide and our over 55,000 California

members, we are writing to register our opposition to the EPA proposed rule.

Mercury is a highly poisonous metal which results in toxicity to the brain and nervous system and toxicity to human reproduction. In addition, in sediments, mercury is bio-transformed into the even more toxic form, methyl mercury, which has resulted in some of the largest epidemics of neuro-developmental poisoning known to mankind. Methyl mercury bioaccumulates in the food chain and thereby results in greatly concentrated exposures to humans, because we eat off the top of the food chain. Underestimates of the toxicity and bioaccumulation of mercury have led to major mistakes in the past. The Minamata Bay disaster in Japan was caused by a failure to predict the potency of mercury and the extent of human exposure through fish. U.S. EPA's Draft Mercury Study Report to Congress documents that children of high-end fish consumers in the U.S. may be exposed to enough mercury to cause adverse neuro-developmental effects.

In this setting it is anomalous to relax the standards for mercury contamination in California water. Furthermore, the scientific reasoning behind the Region 9 EPA decision to relax the mercury standard 60-fold is fraught with errors. NRDC's major concerns with this approach are summarized below.

*Extrapolation for the Reference Dose (RfD) should start at a NOAEL, not at a level of 10% increased risk. *An additional 10-fold safety factor should be added in deriving the RfD to account for the vulnerability of fetuses, infants, and children. *The body weight in the calculation should be for a child, not an adult male. *The Fish consumption rates for those who do eat fish should be used instead of rates for the entire population including those who do not eat fish. *Average fish consumption quantities greatly understate the risk to those who eat a lot of fish. Instead, fish consumption for the top 5% of the population should be used.' *Bioaccumulation is known to be 10 to 100 fold greater than the estimate used by EPA. *California's waters are already too polluted with mercury.

Insufficiently Protective Reference Dose

The risk assessment used the-current reference dose (RfD) from U.S. EPA's Integrated Risk Information System (IRIS) which contains several problems that make it likely to be too high to be health protective. The starting point for the extrapolation was the dose which conferred a I 0% increased risk to exposed humans. This is certainly not a No Observable Adverse Effects Level (NOAEL), and in fact, a 10% increase in risk is quite significant in scientific and public health terms. Despite the fact that the NOAEL was not used as a starting point for derivation of the RfD, only a 10-fold uncertainty factor was added to derive the RfD. This was presumably a half-log of 10 for within human variability and a half-log of 10 for lack of a two generation reproductive study. A half-log of 10 is clearly insufficient to account for the wide range of human variability. In fact, the effects of mercury on the developing nervous system and the appearance of clinical mercury toxicity at much lower doses in children make it highly likely that fetuses, infants, and children are far more than an order of magnitude more susceptible to the effects of mercury intoxication than are adults. Thus an additional factor of at least 10 should be added to account for the disproportionate susceptibility of children.

Incorrect Choice of Body Weight

The body weight used in the equation for the mercury criterion is 70 kg. This is an average adult male body weight. Average female body weight is around 60 kg and a child would weigh less than 10 kg (7.5 kg is a common choice in risk assessment). It is extremely odd to use an adult male body weight in the risk calculation when the populations of interest are pregnant women and children. It is a fact that adult males are simply at much less risk for the adverse health effects of mercury. Choice of an excessively large body weight leads to a larger predicted tolerable dose. Such a large dose might well be tolerable to

an adult male, but in the case of mercury, we are concerned with a different population at risk. Therefore the calculation should use the body weight of the lightest member of the population at risk, ie. the weight of a child, in the equation if there is any hope that the result of the calculation will provide any health protection for a child.

NRDC strongly urges Region 9 EPA to reassess the proposed standard for mercury. Recalculation of the reference dose to accommodate the known disproportionate impact of mercury on fetuses, infants, and children will require addition of at least another 10-fold safety factor. The starting point for RfD calculation should be a true NOAEL. The body weight calculation should use an average weight for a child. Fish consumption data should reflect the "high-end" consumer. Finally, the outdated and unsupportable bioaccumulation factor of 7300 should be discarded in favor of a BAF which is supported by the current science in California.

Response to: CTR-006-001a

Regarding the choice of body weight, EPA disagrees that the use of a 70 Kg body weight is inappropriate for the calculation of the mercury criterion. Although the use of a 70 kg assumption results in a slightly less stringent value, the Agency disagrees that this represents an excessively large body weight. The comment author is also incorrect in the statement that the 70 kg assumption only represents adult males. The 70 kg assumption is, in fact, based on the combined average body weights of adult males and females according to data from the Second National Health and Nutrition Examination Survey (NHANES II). These data indicate that the average body weight for adult females of childbearing age is 65 kg. EPA does not believe that an adjustment of 5 kg would result in a significant change in the mercury criterion. However, EPA is developing a revised methodology for deriving water quality criteria to protect human health and is considering different default body weight recommendations for women of childbearing age and children (see draft revisions published August 14, 1998, Federal Register, Vol. 63, No. 157). EPA is currently reviewing public comments and is awaiting the results of a peer review on the draft methodology revisions. As part of this effort, EPA also intends to consider the more recently published NHANES III data for the same gender and age categories. Until these reviews are complete, it would be inappropriate to change the 70 kg assumption used to calculate the human health criteria for mercury.

EPA disagrees that the body weight of a child should be used for the calculation of the mercury criterion. The effect of concern is a developmental effect which is caused by exposure of the female to mercury and the transmigration of the mercury into the developing fetus to cause the developmental neurotoxic effect. Thus, if the exposure to the pregnant female is reduced to a level which is not toxic to the fetus, then the fetus is protected. This is achieved by calculating a maternal exposure level that corresponds to a NOAEL for developmental effects in the fetus, and in doing so, the weight of the pregnant female is the appropriate number on which to base the calculation.

For issues concerning the derivation of the Reference Dose and safety factors, see the response to CTR-006-002a. Regarding the fish consumption rate, see the response to this issue in CTR-002-002a. Regarding the bioaccumulation issue, see the response in CTR-002-007b.

Comment ID: CTR-006-001b
Comment Author: Natural Resources Defense Cncl
Document Type: Environmental Group
State of Origin: CA

Represented Org:
Document Date: 09/22/97
Subject Matter Code: C-01 Mercury
References:
Attachments? Y
CROSS REFERENCES

Comment: Dear Ms. Frankel,

The Natural Resources Defense Council strongly opposes the Region 9 EPA proposal to raise the allowable mercury criterion for continuous concentration in water from 0.012 parts per billion (ppb) to 0.770 ppb for aquatic life. This proposal is difficult to justify from the point of view of science and of public health. On behalf of our over 350,000 members nationwide and our over 55,000 California members, we are writing to register our opposition to the EPA proposed rule.

Mercury is a highly poisonous metal which results in toxicity to the brain and nervous system and toxicity to human reproduction. In addition, in sediments, mercury is bio-transformed into the even more toxic form, methyl mercury, which has resulted in some of the largest epidemics of neuro-developmental poisoning known to mankind. Methyl mercury bioaccumulates in the food chain and thereby results in greatly concentrated exposures to humans, because we eat off the top of the food chain. Underestimates of the toxicity and bioaccumulation of mercury have led to major mistakes in the past. The Minamata Bay disaster in Japan was caused by a failure to predict the potency of mercury and the extent of human exposure through fish. U.S. EPA's Draft Mercury Study Report to Congress documents that children of high-end fish consumers in the U.S. may be exposed to enough mercury to cause adverse neuro-developmental effects.

In this setting it is anomalous to relax the standards for mercury contamination in California water. Furthermore, the scientific reasoning behind the Region 9 EPA decision to relax the mercury standard 60-fold is fraught with errors. NRDC's major concerns with this approach are summarized below.

*Extrapolation for the Reference Dose (RfD) should start at a NOAEL, not at a level of 10% increased risk. *An additional 10-fold safety factor should be added in deriving the RfD to account for the vulnerability of fetuses, infants, and children. *The body weight in the calculation should be for a child, not an adult male. *The Fish consumption rates for those who do eat fish should be used instead of rates for the entire population including those who do not eat fish. *Average fish consumption quantities greatly understate the risk to those who eat a lot of fish. Instead, fish consumption for the top 5% of the population should be used. *Bioaccumulation is known to be 10 to 100 fold greater than the estimate used by EPA. *California's waters are already too polluted with mercury.

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Response to: CTR-006-001b

With respect to the bioaccumulation factors see response to CTR-002-007b. With respect to the mercury aquatic life criteria, EPA is not promulgating these criteria in today's rule (see the preamble of today's rule for further explanation). For an explanation why EPA does not believe today's rule will worsen water quality see response to CTR-002-003.

With respect to EPA's risk assessment procedures see responses to CTR-006-001a and CTR-006-002a.

Comment ID: CTR-006-002a
Comment Author: Natural Resources Defense Cncl
Document Type: Environmental Group
State of Origin: CA
Represented Org:
Document Date: 09/22/97
Subject Matter Code: C-01 Mercury
References:
Attachments? Y
CROSS REFERENCES C-14

Comment: Dear Ms. Frankel,

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Use of Average Fish Consumption is not Health Protective

The assumption used by Region 9 EPA for fish consumption relies on the average fish and shellfish consumption in the entire general population, along with the average intake from each body of water. It is quite clear that fish consumption follows a highly skewed, or Poisson distribution in the population (see attachment from the U.S. EPA Draft Mercury Study Report to Congress, Appendix H, p. 20). Many people eat little or no fish, but a smaller, yet highly significant segment of the population eats a very large amount of fish. Surely EPA should strive just as hard to protect the health of those who eat fish frequently as it does to protect the health of those who do not eat fish.

In fact, this analysis adequately protects only those who eat little or no fish. The average which was used in the Region 9 EPA analysis appears to derive from the "per capita" data from the USDA Continuing Surveys of Food Intake by Individuals (CSF 11) from 1989-91 for males ages 15-44 years. (See attached tables from U.S. EPA Mercury, Report, Appendix H, pp. 8 & I 1). In fact, this average is highly influenced by those individuals who consume little or no fish. Non-fish-consumers, however, are not the population of interest for purposes of this analysis. Instead, if an average is to be used, it should be the average fish consumption rate for those people who do eat fish. This is substantially higher, at 53.7 g/day for males ages 15-44 years, and 41.4 g/day for females in the same age range. Furthermore, the average fish consumption will likely underestimate the fish consumption rate for the "high end" fish

consumer by many orders of magnitude. For example, in the case of females ages 15-44 years, average fish consumption (among those who do eat fish) is 41.4 g/day, while fish consumption by the top 5% of the population of these women of childbearing age is about 112 g/day, or more than double the average consumption rate.

The implications of not adequately protecting the high fish consumer are not trivial. The population of California is nearly 30 million, of whom overall 31% would be expected to be fish consumers according to the CSF II survey. This represents over 9 million people who would be at disproportionate risk. The top 5% of that population consists of nearly half a million people in California who would be expected to eat fish at nearly 10-times greater quantity than the EPA calculations would predict. 10 times greater consumption would translate into roughly 10-times greater risk from the mercury in the fish. EPA is not adequately protecting this substantial portion of the California population from mercury hazards.

NRDC strongly urges Region 9 EPA to reassess the proposed standard for mercury. Recalculation of the reference dose to accommodate the known disproportionate impact of mercury on fetuses, infants, and children will require addition of at least another 10-fold safety factor. The starting point for RfD calculation should be a true NOAEL. The body weight calculation should use an average weight for a child. Fish consumption data should reflect the "high-end" consumer. Finally, the outdated and unsupportable bioaccumulation factor of 7300 should be discarded in favor of a BAF which is supported by the current science in California.

Response to: CTR-006-002a

The commenter criticizes the current RfD on IRIS in several respects. While EPA intends to develop a revised IRIS value, once it receives recommendations from the National Academy of Sciences (see discussion in response to CTR-030-007 and CTR-002-007b), EPA strongly believes that some level of protection needs to be in place for mercury because of its toxicity to humans and aquatic life (see response to CTR-002-007b). Therefore, EPA thinks it is reasonable to keep in place the human health value based on the current RfD, which it believes is scientifically defensible based on the state of the science at the time it was derived.

The EPA disagrees with the comment that an RfD should be calculated by selecting the NOAEL and applying the appropriate safety factor in the case of mercury due to the nature of the data. The data base for mercury allow for the use of continuous human data (i.e., there are no dose groups and no NOAEL as it is defined for a controlled animal study) on the most sensitive subpopulation which is the fetus.

In regard to the methodology used to calculate the Reference Dose (RfD), the following discussion is intended to clarify why the Benchmark Dose (BMD) approach is the most appropriate method to use for the mercury data. Traditionally, when assessing the human health hazard and dose response relationship for a toxicant which produces a non-cancer effect in humans or animals following exposure, a No Observed Adverse Effect Level (NOAEL) and the Lowest Observed Adverse Effect Level (LOAEL) is selected for the critical effect from among all the available data, and a series of uncertainty factors are applied as appropriate to determine the Reference Dose. This methodology is widely used by regulatory agencies as the first step in assessing potential human health risk from exposure to the substance in question. As more refined mathematical models are developed and better scientific data on toxicants are generated, there is the opportunity to calculate a BMD which more closely approaches the true NOAEL because more of the data and the characteristics of the data are utilized in the analysis. When the data base is robust and such refinements are possible, it is incumbent upon the risk assessors to generate these more realistic estimates of human health hazard for the reasons listed below.

People often misinterpret the NOAEL that is selected from a critical study as the actual level of exposure at which no adverse effects are observed, but actually, it is only the highest level at which no adverse effects are observed in that particular study or in a group of studies. The NOAEL is a function of study design, (i.e., the number of animals tested, the number of doses, the spacing between doses, the duration of exposure, and the route of administration). If the study design has adhered to the toxicity testing guidelines and Good Laboratory Practice (GLP) requirements, the NOAEL actually represents an effect level because of the number of animals used. As the number of test animals increases and more dose levels are tested, the power of the study and its ability to detect a toxic effect increases; the data generated are more robust and the NOAEL decreases as it approaches the real value. Studies with higher power result in lower NOAELs, smaller RfDs and a greater confidence in the level of safety. Also, NOAELs are often controversial since scientific judgment is applied to reach the conclusion that what is observed at the LOAEL is really adverse in nature; and the selection of one number for the NOAEL disregards valuable information gained
from looking at the whole study and the slope of the dose response curve (There is a higher level of concern when the slope is steep because a small change in dose/exposure produces significant changes in the effects noted. Shallow slopes indicate that exposures can be increased over a broader range and the increase in the number or severity of the effects will be less dramatic). Consequently, there are many disadvantages to this methodology, but it is nevertheless frequently used due to the lack of better and more data on the toxicant under review.

However, some toxicants have presented a high level of interest to the scientific community and the regulatory programs and there exists an abundance of toxicology data (often times human data) from which to calculate risk. In these situations, it is preferable to use as much of the data as possible and to select an appropriate model for the data which allows the analyst to determine a Benchmark Dose (BMD). To do this, EPA chooses among a series of appropriate mathematical models. EPA fits each of these to the data. EPA then uses a statistical procedure to select the model that gives the best fit to the data. A BMD is a statistical lower confidence limit on the dose that produces a selected level of change in response rate in comparison to untreated control animals (e.g., 5% or 10% change in response when compared to the background response) (EPA 1995). In other words, the BMD approach selects a data point (point of departure at which there is a certain response level, in this case a 10% response level) and selects the appropriate mathematical model for the data which takes into account the slope of the dose response curve and the variability of the data. For mercury, the BMD thus represents the lower confidence limit for the dose that is estimated to produce the 10% level of change in response in the study population. The BMD thus represents the probability that 95% of the time, the dose producing the given level of response will be higher than the BMD. This approach is well suited to the data base for mercury since the human
data are continuous, i.e., there is a response associated with all exposure levels and there is no non-exposed group. The BMD approach is a newer and more robust analysis which utilizes all the data and the special characteristics of these data, and the Agency would be errant in its mission if it did not utilize state of the art methods in risk assessment to achieve its goals of public health protection. Using this methodology improves the resulting non cancer risk assessment because it uses the dose response data to select an appropriate model which does not extrapolate to doses below the experimental range. The BMD can either be less than or greater than the corresponding NOAEL, it is not restricted to one of the experimental dose levels, and it accounts more appropriately for sample size and dose-response characteristics (Crump 1984, Dourson et al. 1985, Kimmel and Gaylor 1988). In deriving an RfD using this method, the BMD is then divided by the appropriate uncertainty factors. Where the data are appropriate and lend themselves well to the use of a BMD as in the case of the type and quantity of data on mercury, the Agency would be errant in its mission of public health protection if it assessed the hazard of mercury by using the simplistic NOAEL/LOAEL approach.

In the EPA RfD calculation for mercury, an estimate of a NOAEL was used; namely the lower 95% confidence limit on a dose corresponding to a 10% effect level for all reported neurodevelopmental effects reported in a population of 81 Iraqi children reported in Marsh et al. 1987. The 10% effect level refers to the dose which produces the defined effect in 10% of the study population. A Weibull model was fit to the data as recent research suggests that it may be the best model for developmental toxicity data (Faustman et al. 1994). Other research indicates that the lower confidence limit on the dose which produces a 10% response level (i.e., the BMD) is the appropriate choice when correlated with the NOAEL for developmental effects in controlled animal studies (Allen et al. 1994a, b). In the case of the mercury RfD, the 10% effect level was determined to be the most appropriate regarding the aforementioned discussion on compariosn to background response (i.e., statistical significance) and when correlated to the NOAEL. It should be noted that the data on developmental effects in the Iraqi children are continuous with respect to dose. That is, there are no dose groups and no NOAEL as it is defined for a controlled animal study. The benchmark dose modeling procedure provides a reasonable approach to determining the exposure at which effects are observable above background.

EPA also disagrees with the comment that the adult males are at much less risk for the adverse health effects of mercury, and that the RfD should be recalculated with the addition of at least another 10 fold safety factor to accommodate the known disproportionate impact of mercury on fetuses, infants and children. In regard to the sensitivity of adult males vs fetuses, infants and children, the original RfD of 0.3 @g/kg/day was based on paresthesia in Iraqi adults exposed to methylmercury in grain. This is within a factor of three of the current RfD (0.1 @g/kg/day based on developmental neurotoxicity in the same population. According to EPA, an RfD is defined as "an estimate (with uncertainty spanning perhaps an order of magnitude)"of a daily exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effect during a lifetime. Thus, by this "order of magnitude" standard, the RfD based on adult effects overlaps that based on developmental endpoints. In the most recent publications on the poisonings in Minamata, exacerbation or onset of neurological symptoms have been noted as the population has aged.

In regard to the addition of another safety factor for fetuses, infants and children, the scientific community agrees that when deriving an RfD for methylmercury using sensitive developmental neurotoxic endpoints that the data represent the effects in children and fetuses. Thus, an additional 10 fold factor would be redundant. In calculation of the RfD, a composite uncertainty factor of 10 was used to account for a number of uncertainties related to the data. First, this uncertainty factor was applied for variability in the human population, in particular, the wide variation in biological half-life of methylmercury and the variation that occurs in the hair to blood ratio for mercury. In addition, the factor accounts for lack of a two-generation reproductive study and lack of data for possible chronic manifestations of the adult effects (e.g., paresthesia that was observed during gestation). EPA also considers whether to incorporate a modifying factor to address limitations on the data used (e.g., number of animals, sex of animals). The default value of one was used for the modifying factor. Additional discussion regarding the uncertainty factor based on the Marsh et
al 1987, is excerpted from the Mercury Study Report to Congress, 1997, see "Addendum" for this information.

The fish intake rate of 6.5 gm/day is from a national, 30-day survey (the National Purchase Diary), based on an empirical distribution, where 6.5 gm/day represents the average value for the general population. Regarding the fish consumption analysis, the commenter is incorrect on several points.
First, although EPA agrees that fish consumption distributions do tend to be skewed, the Agency disagrees that they follow a Poisson distribution. Nor has the commenter demonstrated that fish consumption follows a Poisson distribution. On the contrary, numerous studies have shown that average fish consumption rates are generally approximated by log-normal distributions. This is specifically true

for the CSFII survey data that the commenter references. The commenter is also incorrect that "many people eat little or no fish." According to the National Purchase Diary (NPD), the basis of the 6.5 gm/day intake rate, 94 percent of the survey respondents stated that they eat some fish. It is not EPA's intention to specifically protect non-consumers of fish. However, survey designs generally, and the referenced CSFII survey in particular, do not allow segregating the data to isolate consumers from non-consumers. The only determination that can be made from the CSFII data is whether a respondent did or did not eat fish during the three consecutive survey days. Therefore, the extrapolation made by the commenter that only 31 percent of the population are fish consumers is incorrect. The commenter is also incorrect that the basis of the chosen intake rate is for males ages 15-44 years. The 6.5 gm/day is based on all respondents from the NPD and, therefore, is representative of males and females in the general population. Further, the "per capita" data submitted by the commenter (from the 1996 draft version of the Mercury Study Report to Congress) are based on rates that include marine species (not used in the water quality criteria derivations), in additon to the estuarine/freshwater species that do comprise the value used in deriving water quality criteria. For additonal discussion regarding the basis of the fish consumption rate, including the exclusion of marine species, see the response to this issue in CTR-002-002a.

Regarding the choice of body weight, see response to CTR-006-001a. Regarding the issues on bioaccumulation, see response to CTR-002-007b.

Comment ID: CTR-006-003
Comment Author: Natural Resources Defense Cncl
Document Type: Environmental Group
State of Origin: CA
Represented Org:
Document Date: 09/22/97
Subject Matter Code: C-01 Mercury
References:
Attachments? Y
CROSS REFERENCES

Comment: Dear Ms. Frankel,

The Natural Resources Defense Council strongly opposes the Region 9 EPA proposal to raise the allowable mercury criterion for continuous concentration in water from 0.012 parts per billion (ppb) to 0.770 ppb for aquatic life. This proposal is difficult to justify from the point of view of science and of public health. On behalf of our over 350,000 members nationwide and our over 55,000 California members, we are writing to register our opposition to the EPA proposed rule.

Mercury is a highly poisonous metal which results in toxicity to the brain and nervous system and toxicity to human reproduction. In addition, in sediments, mercury is bio-transformed into the even more toxic form, methyl mercury, which has resulted in some of the largest epidemics of neuro-developmental poisoning known to mankind. Methyl mercury bioaccumulates in the food chain and thereby results in greatly concentrated exposures to humans, because we eat off the top of the food chain. Underestimates of the toxicity and bioaccumulation of mercury have led to major mistakes in the past. The Minamata Bay disaster in Japan was caused by a failure to predict the potency of mercury and the extent of human exposure through fish. U.S. EPA's Draft Mercury Study Report to Congress documents that children of high-end fish consumers in the U.S. may be exposed to enough mercury to cause adverse

neuro-developmental effects.

In this setting it is anomalous to relax the standards for mercury contamination in California water. Furthermore, the scientific reasoning behind the Region 9 EPA decision to relax the mercury standard 60-fold is fraught with errors. NRDC's major concerns with this approach are summarized below.

*Extrapolation for the Reference Dose (RfD) should start at a NOAEL, not at a level of 10% increased risk. *An additional 10-fold safety factor should be added in deriving the RfD to account for the vulnerability of fetuses, infants, and children. *The body weight in the calculation should be for a child, not an adult male. *The Fish consumption rates for those who do eat fish should be used instead of rates for the entire population including those who do not eat fish. *Average fish consumption quantities greatly understate the risk to those who eat a lot of fish. Instead, fish consumption for the top 5% of the population should be used. *Bioaccumulation is known to be 10 to 100 fold greater than the estimate used by EPA. *California's waters are already too polluted with mercury.

The Bioconcentration Factor is Incorrect

The proposed EPA rule calculates a bioconcentration factor (BCF) in fish of 7300. Available data from the state of California indicates that this factor is wrong by between IO and I 00-fold. In the Great Lakes, mercury has been shown to accumulate with bioaccumulation factors (BAF) of 27,900 for trophic level 3 fish and 140,000 for trophic level 4 fish. Despite this evidence, EPA rejects these data for use in California and calculates a BCF more than 10-fold lower based on a model created 27 years ago. In fact, current data are available on bioaccumulation in California fish.

The San Francisco Bay Regional Monitoring Program has found BAFs of 60,000 to 200,000 in bivalves and research in California lakes has found a calculated BAF of over 500,000 fold. These data have been presented elsewhere in the rulemaking record by researchers from the University of California at Santa Cruz. Underestimating by one to two orders of magnitude the amount of bioaccumulation that will occur in the environment is a major error with potentially devastating public health implications. The potential result is that water will contain "permissible" concentrations of mercury while fish will be contaminated at levels too high for safe human consumption.

California is already Suffering from Mercury Pollution

Numerous water bodies in the state of California are already under fish advisory for mercury. These include Clear Lake, Lake Berryessa, the San Francisco Bay and Delta, Lake Herinan, Guadalupe Reservoir, Calero Reservoir, Almaden Reservoir, Guadalupe River, Guadalupe Creek, and Lake Nacimiento. In the face of this widespread environmental pollution with mercury, all incentives should be driving toward further reduction of mercury emissions and releases to water sources. By relaxing the mercury standards for water, U.S. EPA is heading in absolutely the wrong direction. Increases in allowable levels of mercury in the environment can only lead to more contaminated fish, more fish advisories, more pregnant women and children potentially exposed to this toxic metal, and more risks to public health.

NRDC strongly urges Region 9 EPA to reassess the proposed standard for mercury. Recalculation of the reference dose to accommodate the known disproportionate impact of mercury on fetuses, infants, and children will require addition of at least another 10-fold safety factor. The starting point for RfD calculation should be a true NOAEL. The body weight calculation should use an average weight for a child. Fish consumption data should reflect the "high-end" consumer. Finally, the outdated and unsupportable bioaccumulation factor of 7300 should be discarded in favor of a BAF which is supported

by the current science in California.

Response to: CTR-006-003

Regarding the commenter's statements on the Reference Dose (RfD), refer to the responses on this same issue in CTR-006-001a and CTR-006-002a. Regarding the bioaccumulation issue, see response to CTR-002-007b.

Comment ID: CTR-016-007
Comment Author: San Francisco Bay RWQCB
Document Type: State Government
State of Origin: CA
Represented Org:
Document Date: 09/25/97
Subject Matter Code: C-01 Mercury
References:
Attachments? Y
CROSS REFERENCES

Comment: Comments on the Proposed Mercury Criteria

The Regional Board supports the use of the current Reference Dose from IRIS in deriving the proposed mercury criteria, but we do not agree that the proposed weighted practical average BCF is appropriate for several reasons.

First, is has been our experience that accurate models of bioaccumulative metal uptake require detailed understandings and representations of biogeochemical cycling in aquatic environments. In the absence of a much more detailed, criteria derivation method that accounts for differences between aquatic environments, the Board agrees with current EPA policy that the BAF model used in the Great Lakes Initiative is a more technically sound approach for addressing bioaccumulative substances than approaches using BCFs.

Second, we disagree with EPA's conclusion that data are lacking to determine if the Great Lakes' BAFs are appropriate for use in California. There are ample data sets for derivation of BAFs for coastal waters and the major estuary in the State, as well as detailed water column, invertebrate, and fish tissue data available for mercury in the Sacramento River watershed and reservoir systems affected and unaffected by mercury.(*1) The Board encourages EPA to conduct the same level of analysis for the State of California as it did for the Great Lakes Region using existing data. Towards that end, we have calculated BAFs for two trophic levels for the San Francisco Bay Estuary using data from the San Francisco Buy Regional Monitoring Program according to the methodology outlined in the Great Lakes Initiative. For bivalves (trophic level 3), the field-measured BAF is 23,435; for trophic level 4 fish species typically caught by local fishermen, the field-measured BAF is 144,335.(*2)

The next set of comments relates specifically to the proposed "weighted average practical BCF" method. As written, we believe this method would be appropriate if the goal were to calculate the maximum marginal increase in mercury dose that a population could receive without exceeding the RfD. In other words, this approach allows the weighted dietary average to "dilute" the effects of high levels of mercury in individual water bodies. We do not believe that such an approach is appropriate for the derivation of

criteria that will be used to determine whether mercury levels are affecting uses of individual water bodies in California. Instead, consideration should be given to protecting established beneficial uses that rely on water quality in one stream segment. Our second comment is that it is not clear why EPA is including data for open ocean levels of mercury in the derivation of criteria for inland and estuarine waters. Third, it is also not clear whether the referenced BCFs pertain to the dissolved mercury fraction, or total recoverable and if the latter, why the proposed criteria are in terms of the dissolved fraction. Nor is it clear that the data used to derive the early BCFs were obtained using the ultra clean sampling techniques necessary to obtain true water column concentrations. Improper sampling and analytical techniques would yield higher water column values and lower BCFs than the true measurements.

In summary, the Regional Board requests that EPA calculate an appropriate set of BAFs for mercury applicable to the State of California and not adopt the criteria derived using the proposed method. The proposed mercury criteria are under protective of California waters by several orders of magnitude, and the implicit public concern being protected (average diet of the state's population) is inappropriate. For example, San Francisco Bay is currently listed as a water quality limited segment due to high levels of mercury in fish tissue. The mean dissolved mercury concentration in San Francisco Bay is 0.0019 ug/I and no samples have ever exceeded EPA's proposed standard of 0.05 ug/l.

(*1) It is our understanding that extensive data sets exist for at least Clear Lake, Lake Nacimiento, Cache Creek, Walker Creek, Marsh Creek, the Sacramento River, and the New Almaden mining area. These water bodies encompass most of the types of aquatic systems where mercury levels pose water quality threats in the State.

(*2) Both of these calculations are based on high quality data sets and report wet weight tissue concentrations and dissolved mercury concentrations. Because of the time constraints for comments, they are, however, first-cut estimates using mean reported values. The derivation of a BAF for San Francisco Bay can be made much more precise by separating out location, time, specific species, deployment variables (such as size, growth, and post-deployment bioaccumulation), and available TOC using this data base.

Response to: CTR-016-007

EPA acknowledges the San Francisco Bay Regional Water Quality Board's agreement with EPA's position that a BAF model better represents bioaccumulation potential than a BCF. As noted by the commentor, the issue of mercury bioaccumulation is very complex. EPA is working to improve the knowledge base on mercury bioaccumulation and is in the process of updating its overall method for assessing bioaccumulation and deriving BAFs. EPA's National human health water quality criteria are based on national averages of fish consumption from all relevant sources, which is why the PBCF is based on a weighted average that includes open ocean data. The mercury PBCFs and criteria for human health protection are based on total mercury, not the dissolved total form. Only the freshwater and saltwater CMC and CCC are based on the dissolved inorganic form (Hg-II). For further response to the bioaccumulation issue, refer to response to CTR-002-007b.

Comment ID: CTR-020-004a
Comment Author: City of Stockton
Document Type: Local Government
State of Origin: CA
Represented Org:

Document Date: 09/24/97
Subject Matter Code: C-01 Mercury
References:
Attachments? Y
CROSS REFERENCES

Comment: II. Use of New Scientific Information

The City acknowledges and supports EPA's update of several water quality criteria including those for mercury, cadmium and arsenic. While a number of criteria were updated to reflect current scientific information, there are a few notable exceptions.

The following briefly addresses the key updates and omissions that should be addressed in the final publication of this rule.

A. Criteria that Fail to Reflect Updated Scientific Information

1. Mercury

Mercury criteria were significantly corrected, and the City supports this action. The acute criteria were changed to the dissolved form, the misclassified chronic criteria were changed from 0.012 ppb to 770 ppb, and the human health fish tissue-based criteria were raised from 12 parts per trillion ("ppt") to 50 ppt and now apply at harmonic mean flows. These corrections appear to reflect the latest available scientific information. EPA indicated that the human health criteria were based upon fish tissue contaminant levels. Because the underlying basis for the criteria is an assumed fish tissue contamination level, the human health criteria should either (1) allow for adjustment of the criteria where it is apparent that fish tissue levels are acceptable but the criteria may be exceeded or (2) specify that information on fish tissue contamination may be used as a screening tool to determine if the discharge has a reasonable potential to cause exceedance of the criteria. If the fish tissue data indicate that the existing discharge is acceptable, no limitation should be included in the permit.

Response to: CTR-020-004a

EPA acknowledges the commenter's support for the criteria reflecting the latest scientific information, notwithstanding the fact that the commenter has incorrectly referred to the previous aquatic life criterion of 12 ppt as the previous human health value. Regarding the two options that the commenter presents for human health criteria when the underlying basis is a fish tissue concentration, EPA disagrees that the first option is a plausible scenario, given the BCF-based calculation. EPA believes the reverse scenario is far more likely (i.e., when the fish tissue levels are not acceptable but the water column value is not exceeded). For the second option, EPA agrees that the use of fish tissue is more acceptable for back-calculating from fish tissue concentrations to ambient concentrations in order to determine remaining assimilative capacity.

Comment ID: CTR-020-004b
Comment Author: City of Stockton
Document Type: Local Government
State of Origin: CA
Represented Org:

Document Date: 09/24/97
Subject Matter Code: C-01 Mercury
References:
Attachments? Y
CROSS REFERENCES

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Response to: CTR-020-004b

See response to CTR-020-004a.

Comment ID: CTR-027-012c
Comment Author: California SWQTF
Document Type: Storm Water Auth.
State of Origin: CA
Represented Org:
Document Date: 09/25/97
Subject Matter Code: C-01 Mercury
References: Letter CTR-027 incorporates by reference letters CTR-001, CTR-036 and CTR-040
Attachments? N
CROSS REFERENCES C-22
C-24
G-09
G-05

Comment: PROVISIONS OF THE PROPOSED RULE WE SUPPORT

Not withstanding the above comments, we believe there are certain elements of the proposed rule with respect to establishing water quality standards that we can support:

* Metal criteria expressed in the dissolved fraction rather than expressed in the total recoverable fraction.

* Metal criteria that are developed as a function of the water-effect-ratio (WER).

* The current proposed human health criterion for mercury.

* The current preamble language regarding metal translators and mixing zones.

We believe the above provisions provide a more acceptable, scientific approach to the water quality-based pollution control approach. We recommend these provisions of the current rule remain as proposed.

Response to: CTR-027-012c

EPA acknowledges the commenter's support of the rule.

Comment ID: CTR-030-006
Comment Author: Utility Water Act Group
Document Type: Trade Org./Assoc.
State of Origin: DC
Represented Org:
Document Date: 09/25/97
Subject Matter Code: C-01 Mercury
References:
Attachments? Y
CROSS REFERENCES

Comment: B. The Proposed Mercury Human Health Criterion is Technically Deficient

EPA proposes a human health criterion for mercury of 50 nanograms per liter for California. 62 Fed. Reg. at 42,194. This criterion, while substantially less stringent than that applied in the Great Lakes Water Quality Rule, is technically deficient because assumptions used in developing the criterion are not scientifically defensible. For example, the Bioconcentration Factor (BCF) used in the criterion equation assumes a "steady state" relationship between mercury levels in the water column and mercury levels in fish. In fact, the California proposal's preamble states "the BCF is defined as the ratio of chemical concentration in the organism to that in the surrounding water." 62 Fed. Reg. at 42,179, col. 3. The preamble also references EPA's water quality criteria document for mercury, which stipulates that "These [BCF] calculations depend upon a number of assumptions. The basic assumption is that, on the average, the concentration of methylmercury in fish muscle is related to the concentration of total mercury in water. This might be true if (1) methylmercury on the average is a constant fraction of total mercury in water . . . " Ambient Water Quality Criteria for Mercury, EPA 440/5-80-058 (October 1980) (Mercury Criteria Document) at C-25 to C-28. However, the ratio of mercury in the water column to mercury

levels in fish is not a "steady state" but can vary by as much as a factor of 100, particularly in streams and littoral areas of larger bodies of water. This variability is described at length in the Proceedings of the Third International Conference on Mercury as a Global Pollutant, reprinted in Water, Air and Soil Pollution Journal 80 (1-4) 1995 (Proceedings of Third International Conference). The preamble to the California proposal does not address the variability of totalmercury concentrations in the water column, but acknowledges the variability in the ratio of methylmercury to total mercury concentrations in the water column, stating:

To a considerable degree the magnitude of the BAF for mercury in a given system depends on how much of the total mercury in that system is present in the methylated form. Methylation rates vary widely from one aquatic system to another for reasons that are not fully understood.

62 Fed. Reg. at 42,180, cols. 1-2. Having acknowledged that methylation rates vary widely, EPA should not employ a model which is preconditioned on the existence of constant methylation rates.

UWAG also notes the following additional questionable assumptions of the proposed criterion.

* The criterion does not adequately acknowledge fate and transport processes such as evasion and deep sediment burial, which in many aquatic systems can remove 90 percent or more of the available mercury. Although the California proposal incorporates the concept of mixing zones, mixing zones only provide for partial consideration of the fate and transport mechanisms which reduce water column concentrations of mercury. Fate and transport processes - particularly evasion - take place over several days whereas mixing is a more instantaneous process. Since fish bioaccumulate mercury over their lifespan, it is the range of mercury concentrations that fish experience over their entire life (and not the concentration at the edge of a mixing zone) which is of concern. A subcommittee of EPA's Science Advisory Board (SAB) has criticized EPA's fate and transport models for ignoring evasion. In its recent report, the Subcommittee states: "It is unfortunate that soil and water loss degradation constants were not incorporated in the model. Several recent studies have shown that (elemental) Hg production and evasion are common processes in soils and surface waters." SAB, Report of the Mercury Review Subcommittee, Executive Committee Review Draft, dated June 30, 1997, p. 30.

* The RfD is inappropriate because it is based on a chronic exposure study done in Iraq under poor field conditions. Newer and much better data are available from a number of studies, including those conducted in the Seychelles Islands. (See 11 papers presented in Neurotoxicology Vol. 16, no. 4 (1995)). These data should be evaluated and should result in a larger RfD.

* The California proposal's BCFs (*2) are not valid because they use erroneous water column concentrations and arbitrary fish concentrations. The open ocean mercury concentration of 15 ng/l apparently was taken from an outdated 1979 report by Fitzgerald. In more recent peer-reviewed literature, Fitzgerald identifies the open ocean mercury concentration as more than ten fold less than the cited values (see Proceedings of Third International Conference, particularly "Methylation and Elemental Mercury Cycling in Surface and Deep Ocean Water of the North Atlantic" by Mason, Rolfus and Fitzgerald). The 17 ng/l estuarine and 40 ng/l fresh water values are similarly off by a factor of ten.(See Proceedings of Third International Conference, particularly "Mercury Speciation in the Scheldt Estuary" by Leermakers et al., and "Mercury Concentrations in Two Great Waters" by Cleckner et al.) Moreover, the range of concentrations between water bodies is great and prompted the SAB Subcommittee to conclude that BAFs (and, presumably, BCFS) can only be derived and used on a site-specific basis. The Subcommittee similarly concluded that fish mercury concentrations between various species in a given body of water vary dramatically.

* Furthermore, the BCFs are not valid for use in the California proposal because they were developed primarily on the basis of species from the Eastern half of the United States and the Atlantic Ocean (e.g., sardines). See Mercury Criteria Document.

For all of these reasons, UWAG believes the proposed human health mercury criterion is fundamentally flawed and should be subject to rigorous reevaluation by the Agency.

(*2) The term BCF is used inconsistently in the California proposal's preamble and in the Mercury Criteria Document. In the preamble, BCF is defined as fish uptake of mercury by respiration alone and specifically excludes mercury uptake through ingestion of food. The preamble goes to considerable length to explain that uptake by both respriation and ingestion is a different process defined as bioaccumulation. The preamble explains that a criterion based on bioaccumulation is not being considered at this time but may be incorporated into future rulemakings. The preamble then explains how its bioconcentration values were taken from the Mercury Criteria Document. That document, however, uses the term "bioconcentration" in a completely different sense. Bioconcentration, as used in the Mercury Criteria Document, is actually bioaccumulation as defined in the 1997 preamble. The Mercury Criteria Document derives its bioconcentration values from actual fish levels measured in ocean and lake fish caught for commercial purposes. Consequently, those fish were exposed to mercury both from the water column and from their food sources. Bioconcentration factors (as the term is defined in the 1997 preamble) can only be obtained from fish reared in carefully constructed laboratory experiments where the diet is purposefully devoid of the naturally occurring mercury commonly found in natural forage.

Response to: CTR-030-006

EPA agrees with the commenter that considerable variability can exist in both total and methymercury concentrations in the water column. However, predicting the amount of methylmercury present for a given concentration of total mercury is very difficult. The amount of methylmercury formed is affected by numerous chemical, physical, and biological factors which are not well understood. Examples of these include: foodchain interactions; physicochemical parameters (e.g., pH, temperature, dissolved and particulate organic matter); and size and type of watershed. It is readily acknowledged that mercury is toxic, causing a variety of adverse effects to both humans, fish, and wildlife. Thus, methods are need to assess mercury exposure and effects, and to control its release to the environment. These issues are discussed in the Mercury Study Report to Congress, (EPA-452/R-97-008); The National Survey of Mercury Contamination in Fish. Database Summary 1990-1995. September 29, 1997; 1995 Updates: Water Quality Criteria Documents for the Protection of Aquatic Life in Ambient Water, (EPA-820-B-96-001); and Final Water Quality Guidance for the Great Lakes System: Final Rule. Fed Register, 60(56):15366-15425 (March 23, 1995). EPA is not aware of any method to accurately predict concentrations of methylmercury in the water column and subsequent bioaccumulation in aquatic biota, nor does the commenter suggest any method. Although there are a few fate/transport models that could be used to assess the fate of mercury in the environment, these models are still in developmental stages, have only been applied under a narrow range of environmental and biological conditions, and will require validation before they are ready for use on a broad scale. Therefore, EPA believes that the use of BCFs represents the most appropriate method at this time for use in the CTR. Furthermore, as suggested by the commenter, EPA is currently undergoing a comprehensive review of the human health mercury criteria, in addition to the overall hman health criteria derivation methodology. Once this review is complete, EPA intends to revise its National human health mercury criteria, and subsequently update California's mercury criteria. For further response to the bioaccumulation issue, refer to response to comment for

CTR-002-007b.

Regarding comments on the Reference Dose (RfD), EPA has on two occasions published RfDs for methyl mercury which have represented the Agency consensus for that time. These are described in the sections below. The original RfD of 0.3 @g/kg/day was determined in 1985. The current RfD of 0.1 @g/kg/day was established as Agency consensus in 1995, based on the study by Marsh et al. 1987. The Agency is aware of all the additional data that have become available since the calculation of the current RfD. At the time of the generation of the Mercury Study Report to Congress, it became apparent that considerable new data on the health effects of methyl mercury in humans were emerging. Among these are large studies of fish, or fish and marine mammal, consuming populations in the Seychelles and Faroes Islands. Smaller scale studies are in progress which describe effects in populations around the Great Lakes.

However, as much of this new data have either not yet been published or have not yet been subject to rigorous peer review, it was decided that it was premature for EPA to make a change in the 1995 methyl mercury RfD at this time. This decision was approved by the Science Advisory Board (SAB), a public advisory group providing extramural scientific information and advice to the Administrator and other officials of the EPA. The SAB is structured to provide balanced, expert assessment of scientific matters relating to problems facing the Agency. Their report makes the following statement.

"In general, from the standpoint of looking at human health effects and the uncertainties, the draft report is a very good document and an important step forward in terms of bringing the relevant information together into one place for the first time. The current RfD, based on the Iraqi and New Zealand data, should be retained at least until the on-going Faroes and Seychelles Islands studies have progressed much further and been subjected to the same scrutiny as has the Iraqi data."

The SAB report continues:

"Investigators conducting two new major prospective longitudinal studies--one in the Seychelles Islands the other in the Faroe Islands--have recently begun to publish findings in the literature and are expected to continue releasing their findings during the next 2-3 years. These studies have advantages over those cited in the previous paragraph in that they have much larger samples sizes, a larger number of developmental endpoints, potentially more sensitive developmental endpoints, and control a more extensive set of potential confounding influences. On the other hand, the studies have some limitations in terms of low exposures (to PCBs in the Faroes) and ethnically homogenous societies. Since only a small portion of these new data sets have been published to date and because questions have been raised about the sensitivity and appropriateness of the several statistical procedures used in the analyses, the Subcommittee concluded that it would be premature to include any data from these studies in this report until they are subjected to appropriate peer review. Because these data are so much more comprehensive and relevant to contemporary regulatory issues than the data heretofore available, once there has been adequate opportunity for peer review and debate within the scientific community, the RfD may need to be reassessed in terms of the most sensitive endpoints from these new studies."

An inter-agency process, with external involvement, will be undertaken for the purpose of reviewing these new data, their evaluations, and the evaluations of existing data. An outcome of this process will be an assessment by EPA of its RfD for methyl mercury to determine if a change is warranted.

Comment ID: CTR-030-007

Comment Author: Utility Water Act Group
Document Type: Trade Org./Assoc.
State of Origin: DC
Represented Org:
Document Date: 09/25/97
Subject Matter Code: C-01 Mercury
References:
Attachments? Y
CROSS REFERENCES

Comment: C. EPA Should Delay Promulgation of a Mercury Human Health Criterion Until SAB Subcommittee Comments

In forming a SAB subcommittee to comment on its draft Mercury Report to Congress, EPA has engaged a group of very knowledgeable scientists to assist it in understanding the fate and transport of mercury. That subcommittee has prepared draft comments and will finalize those comments within the next few months. EPA should review and evaluate the Subcommittee's final comments before promulgating mercury criteria for California.

Response to: CTR-030-007

EPA has reviewed and incorporated all of the SAB subcommittee's final comments that are possible to incorporate at this time. However, there are further analyses on mercury that are in progress. EPA has entered into an 18-month agreement with the National Academy of Sciences (NAS) to resolve outstanding issues with the mercury risk assessment. Additionally, EPA is in the process of developing methods to more accurately measure bioaccumulation, as part of the revisions to the human health methodology for deriving water quality criteria. After finalization of the methodology and completion of the NAS agreement, EPA intends to update its criterion for mercury. Until that time, EPA believes that the proposed CTR criteria value for mercury is appropriate and reflects the best available scientific information.

Comment ID: CTR-032-006a
Comment Author: Las Gallinas Val. Sanitry Dist
Document Type: Sewer Authority
State of Origin: CA
Represented Org:
Document Date: 09/25/97
Subject Matter Code: C-01 Mercury
References: Letter CTR-032 incorporates by reference letter CTR-035
Attachments? N
CROSS REFERENCES C-24

Comment: Mercury Criteria

The District supports the proposed revised human health criteria for mercury based on updated IRIS information. The District also supports EPA's decision (CTR P. 42180) not to apply the bioaccumulation factor (BAF) developed for the Great Lakes Initiative to the CTR mercury criteria. We agree that mercury methylation rates vary widely and are not well understood, particularly for amalgam related

mercury. We believe that adoption of a national BAF under consideration as part of the "Mercury Study Report to Congress: SAB Review Draft" is inappropriate for California, particularly for the complex San Francisco Bay system. CDA recommends that EPA direct the State to develop a site specific objective (SSO) for mercury for San Francisco Bay based on a site specific BAF and data on natural cleanup processes and methylation processes. The proposed CTR criteria should serve as interim criteria until the SSO is developed and adopted.

Response to: CTR-032-006a

EPA acknowledges the commenter's support of the rule. Regarding the recommendation for a "site-specific objective" for mercury in San Francisco Bay, EPA always advocates that states develop site-specific criteria when local data are available. However, EPA also believes that protective defaults are appropriate.

Comment ID: CTR-035-002b
Comment Author: Tri-TAC/CASA
Document Type: Trade Org./Assoc.
State of Origin: CA
Represented Org:
Document Date: 09/25/97
Subject Matter Code: C-01 Mercury
References:
Attachments? N
CROSS REFERENCES C-22
C-08a
G-05
G-04
G-09
K-01
C-24a

Comment: Second, we commend EPA for its inclusion in the CTR of several innovative and flexible regulatory approaches, such as metals criteria expressed as dissolved rather than total recoverable concentrations, and the revised human health criterion for mercury. In addition, in light of the issues surrounding the human health criteria for arsenic we support EPA's decision not to promulgate human health criteria at this time. With respect to implementation issues discussed in the Preamble, we support EPA's policies and guidance regarding the application of mixing zones and dilution credits. the use of interim permit limits while Total Maximum Daily Loads (TMDLs) and other special studies are being performed, and EPA's guidance to Regional Water Quality Control Boards (RWQCBs) that they may use any of the methods described in EPA's guidance document on the use of translators. We also support EPA's proposal to create a rebuttable presumption for Water Effects Ratios (WERs), allowing the RWQCBs and SWRCB to develop site-specific WERs that can be approved by EPA during the NPDES permit approval process. We believe that this approach will help facilitate the development of appropriate site-specific adjustments for metals criteria.

Response to: CTR-035-002b

EPA acknowledges the commenter's support of the rule.

Comment ID: CTR-035-026
Comment Author: Tri-TAC/CASA
Document Type: Trade Org./Assoc.
State of Origin: CA
Represented Org:
Document Date: 09/25/97
Subject Matter Code: C-01 Mercury
References:
Attachments? N
CROSS REFERENCES

Comment: pp. 42179-42180 -- Mercury Criteria We support EPA's promulgation of revised human health criteria for mercury based on updated IRIS information We also support EPA's decision not to apply the bioaccumulation factor (BAF) developed for the Great Lakes in the Great Lakes Initiative to the CTR mercury criteria. We agree that there is insufficient evidence at this time to substantiate whether this is an appropriate BAF for California. Further, we question whether a single BAF should be developed in the future for California, given the varied nature of the water bodies in the State -- ranging from the Bay-Delta in northern California to concrete-lined effluent-dominated streams and the saline, agricultural drainage-dominated Salton Sea in southern California -- as well as the variation in methylation rates and the amount of methylated mercury in these varied ecosystems. For these reasons, we also doubt that it is possible to derive a valid national BAF for mercury.

Response to: CTR-035-026

EPA acknowledges the comment on the Agency's choice not to use a BAF for the mercury criterion. EPA believes that the use of a BCF is most appropriate at this time for the CTR. EPA further understands the complexity surrounding the issue of bioaccumulation and is currently working on improving its methodology, including evaluating the impact that the type of water body has on bioaccumulation.

Comment ID: CTR-038-002c
Comment Author: Sonoma County Water Agency
Document Type: Sewer Authority
State of Origin: CA
Represented Org:
Document Date: 09/25/97
Subject Matter Code: C-01 Mercury
References:
Attachments? Y
CROSS REFERENCES C-22
C-24a
G-04
G-05
G-09

Comment: 2. The following provisions of the rule are supported (1) adoption of metals criteria as dissolved concentrations; (2) expression of the metals criteria as a function of the water-effect ratio; (3) adoption of the proposed new human health criterion for mercury; and (4) the Preamble discussions regarding metals translators, mixing zones, and interim permit limits.

Response to: CTR-038-002c

EPA acknowledges the provisions of the rule supported by the commenter.

Comment ID: CTR-039-005
Comment Author: San Francisco BayKeeper
Document Type: Environmental Group
State of Origin: CA
Represented Org:
Document Date: 09/25/97
Subject Matter Code: C-01 Mercury
References:
Attachments? N
CROSS REFERENCES

Comment: III. EPA'S PROPOSED MERCURY NUMBER IS FLAWED BECAUSE IT IGNORES RELEVANT DATA REGARDING ITS POTENTIAL TO BIOACCUMULATE

EPA's proposed mercury number, in addition to using an inappropriate fish and shellfish consumption rate, also fails to factor in bioaccumulation of mercury into fish tissue. Assuming EPA is accurate in that it does not know the specific potential for mercury to bioaccumulate in waters of the State of California, it is certain that some rate of bioaccumulation is occurring. Unfortunately, EPA only applies a bioconcentration factor, ignoring the mercury that is entering fish through their own food consumption. In fact, in at least one region of the State -- the San Francisco Bay area -- there is ample data from which an accurate bioaccumulation factor can be determined. See Comments of Communities For A Better Environment. That factor is comparable to the rate of bioaccumulation observed in Great Lakes fish, which is from four times to 20 times greater than EPA's proposed bioconcentration factor.

Response to: CTR-039-005

EPA acknowledges the comments made on the use of BCFs. EPA believes that this represents the most appropriate method at this time for use in the CTR. EPA further understands the complexity surrounding the issue of bioaccumulation and is currently working on improving its methodology. Regarding the fish consumption rate, see the response to this issue in CTR-002-002a. Regarding bioaccumulation and available data from the San Francisco Bay area, see response to CTR-002-007b.

Comment ID: CTR-040-002b
Comment Author: County of Sacramento Water Div
Document Type: Storm Water Auth.
State of Origin: CA
Represented Org:
Document Date: 09/25/97

Subject Matter Code: C-01 Mercury
References: Letter CTR-040 incorporates by reference letter CTR-027
Attachments? Y
CROSS REFERENCES C-24a
G-09
G-05

Comment: PROVISIONS SUPPORTED

We support a number of provisions of the Rule, including: (1) adoption of metals criteria as dissolved concentrations; (2) expression of the metals criteria as a function of the water-effect ratio; (3) adoption of the proposed new human health criterion for mercury- and (4) the Preamble discussions regarding metals translators and mixing zones. These provisions provide a firmer scientific base for the water quality-based approach to pollution control and are a marked improvement over the old Inland Surface Waters Plan. We would urge EPA to retain these provisions in the final Rule.

Response to: CTR-040-002b

EPA acknowledges the provisions of the rule supported by the commenter.

Comment ID: CTR-041-004
Comment Author: Sacramento Reg Cnty Sanit Dist
Document Type: Sewer Authority
State of Origin: CA
Represented Org:
Document Date: 09/25/97
Subject Matter Code: C-01 Mercury
References:
Attachments? N
CROSS REFERENCES

Comment: Third, the District strongly supports the revised human health criteria for mercury, and EPA's recognition that bioaccumulation factors (BAF) from the Great Lakes are highly unlikely to be applicable in the diverse California environment. Consequently, the District does not believe that the proposal to develop a national BAF for mercury is scientifically sound. The use of most recently available and applicable data from EPA's resources to revise the human health criteria is the type of sound scientific procedure that should be used. Similarly, EPA's recognition that mercury methylation, the key to the magnitude of the BAF for a given system, is widely variable and not understood is also welcomed and supported. Given these statements in the proposal, however, EPA's subsequent proposal to develop a national BAF has little merit and is not supported by the District.

Response to: CTR-041-004

EPA disagrees that its effort to derive national default bioaccumulation factors for mercury are inappropriate. EPA acknowledges the complexity of mercury biogeochemical cycling and bioaccumulation in aquatic ecosystems, but believes that need to control mercury risks to humans

warrants the development of national, default human health criteria that reflect the latest science on mercury toxicity and bioaccumulation. EPA is aware of only one comprehensive model on mercury cycling and bioaccumulation that has been developed (the Mercury Cycling Model) and believes, at this time, that the model cannot be extrapolated with sufficient certainty to ecosystems that differ substantially upon which it was based (i.e., northern oligotrophic lakes). This model was specifically developed with northern oligotrophic lakes and reservoirs in mind, and EPA believes at this time it can not be extrapolated with sufficient certainty to ecosystems that differ substantially from this (e.g., streams, rivers, estuaries), and for which mercury bioaccumulation is also an important issue. This uncertainty exists partly because the model represents ecosystem dynamics rather simplistically, though more because of limitations in the science than by preference. Mercury bioaccumulation to higher order trophic levels influenced heavily by the type of food chain (i.e. benthic or pelagic based) and complexity of food chain interactions. The model must make assumptions about food chain interactions that limit the models predictive capability. Uptake and depuration of mercury in natural systems is also difficult to measure and predict, the model must make assumptions about these processes that limit its predictive capability. In order to minimize the effect that model assumptions have on predicting mercury uptake for a given application, it is necessary to have some local hydrological, physical, and biological data to calibrate the model. In most cases, such data is not available. Such limitations are common for most predictive models. Terefore, given the state of the science for the few available models, and because EPA must address mercury bioaccumulation for a broad range of aquatic ecosystems (e.g. lakes, streams, estuaries), EPA believes at this time it is most appropriate to derive BAFs for mercury. EPA is currently collecting data on bioaccumulation for all aquatic ecosystems, however, it is unclear whether BAFs will be developed separately for each type of aquatic system or if one value will be derived for application to all aquatic systems. Therefore, EPA anticipates the need to develop BAFs for mercury which have applicability to a broad range of aquatic ecosystems (rivers, lakes, estuaries). At this time, it is unclear whether BAFs will be developed separately for each type of waterbody because EPA is currently collecting and evaluating mercury bioaccumulation data.

Comment ID: CTR-041-007a
Comment Author: Sacramento Reg Cnty Sanit Dist
Document Type: Sewer Authority
State of Origin: CA
Represented Org:
Document Date: 09/25/97
Subject Matter Code: C-01 Mercury
References:
Attachments? N
CROSS REFERENCES C-22

Comment: 2. Additional Strong Reasons to Maintain use of Dissolved Metals and Mercury Criteria

The District also has significant economic reasons to support the use of dissolved metals and the updated mercury criteria. Previous District studies have shown that adoption of metal criterion as total recoverable would cost the District more than $50 million a year while reducing metal loads in the Sacramento River by several percent. Likewise, if old mercury criteria were adopted it would cost the District over $100 million a year while reducing mercury loads in the Sacramento River by several percent.

Response to: CTR-041-007a

EPA acknowledges the commenter's support, however the commenter did not provide enough information for EPA to comment on its cost estimate related to total recoverable criteria and the old mercury criteria.

Comment ID: CTR-043-002c
Comment Author: City of Vacaville
Document Type: Local Government
State of Origin: CA
Represented Org:
Document Date: 09/26/97
Subject Matter Code: C-01 Mercury
References:
Attachments? Y
CROSS REFERENCES C-22
C-24a
G-04
G-05
G-09

Comment: 2. The following provisions of the rule are supported: (1) adoption of metals criteria as dissolved concentrations; (2) expression of the metals criteria as a function of the water-effect ratio; (3) adoption of the proposed new human health criterion for mercury; and (4) the Preamble discussions regarding metals, translators, mixing zones and interim permit limits.

Response to: CTR-043-002c

EPA acknowledges the provisions of the rule supported by the commenter.

Comment ID: CTR-044-003c
Comment Author: City of Woodland
Document Type: Local Government
State of Origin: CA
Represented Org:
Document Date: 09/26/97
Subject Matter Code: C-01 Mercury
References:
Attachments? Y
CROSS REFERENCES C-22
C-24a
G-09
G-05
G-04

Comment: We have reviewed the proposed CTR and offer the following comments:

2. The following provisions of the rule are supported:

(1) adoption of metals criteria as dissolved concentrations;

(2) expression of the metals criteria as a function of the water-effect ratio;

(3) adoption of the proposed new human health criteria for mercury; and

(4) the Preamble discussions regarding metals translators, mixing zones, and interim permit limits.

Were the old human health criterion for mercury (0.012 ug/ l) to be adopted, the City would have to remove its discharge from Tule Canal and go to land disposal. The capital cost to do this would be $22.1 million and the total present worth cost would be $23.1 million (see Exhibit B, Required Capital improvements and Costs for Beryllium and Mercury). This would translate to an annual cost of $3.1 million per year (at 7% over 10 years) and would require that monthly sewer service charges be increased by more than 100%.

Response to: CTR-044-003c

EPA acknowledges the provisions of the rule supported by the commenter.

Comment ID: CTR-045-006
Comment Author: Sausalito-Marin Sanitary Dist.
Document Type: Sewer Authority
State of Origin: CA
Represented Org:
Document Date: 09/24/97
Subject Matter Code: C-01 Mercury
References:
Attachments? Y
CROSS REFERENCES

Comment: The District supports many of the items included in the proposed CTR:

The revised human health criterion for mercury.

Response to: CTR-045-006

EPA acknowledges the commenter's support of the mercury criterion.

Comment ID: CTR-051-003a
Comment Author: Cal. RWQCB Central Valley Reg.
Document Type: State Government
State of Origin: CA
Represented Org:
Document Date: 09/26/97
Subject Matter Code: C-01 Mercury
References:

Attachments? N
CROSS REFERENCES

Comment: Mercury

The proposed mercury criteria are not appropriate for California waters and could seriously undermine ongoing regulatory and watershed efforts to address regionwide mercury concerns. In the Central Valley Region, existing ambient concentrations of dissolved mercury are two orders of magnitude lower than the proposed criteria, yet there are widespread beneficial use impairments that result form elevated mercury levels in fish. There are consumer advisories in effect in the Delta, Clear Lake and Lake Berryessa because of elevated fish tissue levels of mercury. There is widespread concern about mercury bioaccumulation in fish and wildlife. Mercury cycling and transfer through the ecosystem is very complicated. More research is needed to determine which sources and forms of mercury, in California, are important in controlling how much mercury is concentrated in aquatic systems. Also, use of national orstatewide fish consumption values are inappropriate. Subsistence fishing is practiced by many of California's subpopulations. Protection of these subpopulations necessitates establishing site specific consumption estimates upon which to base a criterion. For the reasons stated above, the proposed criteria for mercury should not be adopted.

Please call me at (916)255-3087 or Jerry Bruns at (916)255-3093 if you have any questions regarding these comment.

Response to: CTR-051-003a

EPA disagrees that its program to derive national default criteria is inappropriate. EPA understands that conditions vary from state to state and can vary among different site-specific locations within a given state. However, under Section 304(a) of the Clean Water Act, EPA is required to develop, and from time to time revise, such default criteria to help protect human health and designated uses of the nation's water bodies. As such, EPA believes that the criteria program is necessary and appropriate. The State will be translating the state's narrative criteria, site-specifically, to better account for exposure to mercury. The State will also develop regulatory controls that will protect designated uses. If there is widespread beneficial use impairment, then these waterbodies will appear on EPA's 303 list for TMDL development and protective target goals for the waterbodies will be addressed as part of that process. In addition, EPA will be updating its human health water quality criteria methodology to better reflect exposures through the food chain.

Regarding the fish consumption values chosen, see response to CTR-002-002a.

Comment ID: CTR-051-003b
Comment Author: Cal. RWQCB Central Valley Reg.
Document Type: State Government
State of Origin: CA
Represented Org:
Document Date: 09/26/97
Subject Matter Code: C-01 Mercury
References:
Attachments? N

CROSS REFERENCES

Comment: Mercury

The proposed mercury criteria are not appropriate for California waters and could seriously undermine ongoing regulatory and watershed efforts to address regionwide mercury concerns. In the Central Valley Region, existing ambient concentrations of dissolved mercury are two orders of magnitude lower than the proposed criteria, yet there are widespread beneficial use impairments that result form elevated mercury levels in fish. There are consumer advisories in effect in the Delta, Clear Lake and Lake Berryessa because of elevated fish tissue levels of mercury. There is widespread concern about mercury bioaccumulation in fish and wildlife. Mercury cycling and transfer through the ecosystem is very complicated. More research is needed to determine which sources and forms of mercury, in California, are important in controlling how much mercury is concentrated in aquatic systems. Also, use of national orstatewide fish consumption values are inappropriate. Subsistence fishing is practiced by many of California's subpopulations. Protection of these subpopulations necessitates establishing site specific consumption estimates upon which to base a criterion. For the reasons stated above, the proposed criteria for mercury should not be adopted.

Please call me at (916)255-3087 or Jerry Bruns at (916)255-3093 if you have any questions regarding these comment.

Response to: CTR-051-003b

See responses to CTR-002-007b and CTR-051-003a.

Comment ID: CTR-052-002b
Comment Author: East Bay Dischargers Authority
Document Type: Sewer Authority
State of Origin: SC
Represented Org:
Document Date: 09/26/97
Subject Matter Code: C-01 Mercury
References: Letter CTR-052 incorporates by reference letters CTR-035 and CTR-054
Attachments? Y
CROSS REFERENCES C-22
G-09
G-05
G-04

Comment: EPA will recall the State Water Quality Plans Task Forces that included all stakeholders, including EPA. The Authority appreciates the incorporation of many of the consensus recommendations from the Task Forces into the CTR, including:

* Adoption of the metals criteria as dissolved concentrations and the expression of the criteria as a function of the water-effect ratio

* Adoption of the proposed new human health criterion for mercury

* Preamble discussions regarding metals translators, mixing zones, and interim permit limits

Response to: CTR-052-002b

EPA acknowledges the commenter's support of the consensus recommendations.

Comment ID: CTR-053-003a
Comment Author: Heal the Bay
Document Type: Environmental Group
State of Origin: CA
Represented Org:
Document Date: 09/26/97
Subject Matter Code: C-01 Mercury
References: Letter CTR-053 incorporates by reference letter 6 and the comments on Dioxin, copper, and the compliance schedule from letter CTR-002
Attachments? N
CROSS REFERENCES C-02b
C-09a

Comment: In spite of our lack of detailed comments for specific criteria, we have concerns regarding any weakening of California's previously developed standards, particularly those for mercury and copper. Also, we question the absence of criteria for dioxin and dioxin-like compounds. In order to ensure these issues are considered in future improvements of the Rule, we incorporate by reference the comments of the Natural Resources Defense Council regarding mercury, and the comments of Communities for a Better Environment ("CBE") regarding dioxin compounds and copper.

Response to: CTR-053-003a

With respect to the comment on mercury see responses to CTR-002-007b and 006-001b. With respect to the comments on copper and dioxin see response to CTR-002-003.

Comment ID: CTR-054-003
Comment Author: Bay Area Dischargers Assoc.
Document Type: Sewer Authority
State of Origin: CA
Represented Org:
Document Date: 09/25/97
Subject Matter Code: C-01 Mercury
References:
Attachments? Y
CROSS REFERENCES

Comment: BADA supports the adoption of the proposed new human health criterion for mercury. Several of the BADA agencies would have serious attainability problems with the old EPA human health criteria for mercury, whereas none have a problem with the criteria proposed in the CTR. Although we concur with environmental groups testifying at the September 17 hearing that mercury is a major

problem, there is little to be gained through more stringent regulation of point sources. Mercury levels of concern in water and tissue are largely the result of unregulated nonpoint sources, namely abandoned mines and downstream sediments. The way to address mercury is through the watershed management approach and control of nonpoint sources. BADA's support for the new mercury criteria is not meant to imply that BADA agencies are unwilling to implement reasonable source controls aimed at reducing mercury levels in our discharges or to participate in watershed management studies aimed at reducing nonpoint sources of mercury. On the contrary our agencies support and are committed to such activities.

Response to: CTR-054-003

EPA acknowledges the commenter's support of the rule and proposed mercury criterion.

Comment ID: CTR-056-003
Comment Author: East Bay Municipal Util. Dist.
Document Type: Sewer Authority
State of Origin: CA
Represented Org:
Document Date: 09/22/97
Subject Matter Code: C-01 Mercury
References: Letter CTR-056 incorporates by reference letter CTR-054
Attachments? N
CROSS REFERENCES

Comment: Second, EBMUD would like to express to EPA it support for inclusion of:

* The revised human health criterion for mercury based on data from more current research than for the National Toxics Rule criteria,

Response to: CTR-056-003

EPA acknowledges the commenter's support of the proposed mercury criterion.

Comment ID: CTR-058-010
Comment Author: Western States Petroleum Assoc
Document Type: Trade Org./Assoc.
State of Origin: CA
Represented Org:
Document Date: 09/26/97
Subject Matter Code: C-01 Mercury
References:
Attachments? Y
CROSS REFERENCES

Comment: Mercury. WSPA concurs with EPA that mercury BAFs for a particular water body is highly dependent on the amount of organic mercury in that system. At this time WSPA supports the use of the BCFs until a more representative estimate of BASFs in pertanent water bodies in California can be

established.

Response to: CTR-058-010

EPA agrees with these comments supporting a five year compliance schedule.

Comment ID: CTR-059-009
Comment Author: Los Angeles County Sanit. Dist
Document Type: Sewer Authority
State of Origin: CA
Represented Org:
Document Date: 09/26/97
Subject Matter Code: C-01 Mercury
References: Letter CTR-059 incorporates by reference letter CTR-035
Attachments? Y
CROSS REFERENCES

Comment: Mercury Human Health Criteria

EPA has proposed human health criteria for mercury for consumption of water and organisms (0.05 ug/L) and for consumption of organisms only (0.051 ug/L). We have a number of concerns about these criteria and recommend that EPA defer adoption or revise them for the final rule.

First, we can find no basis for the range of Bioconcentration Factors (BCFs) listed in the CTR Administrative Record Matrix (ARM). The ARM lists BCFs for mercury ranging from 3,765 to 9,000. No specific references are provided in the 1986 criteria document (the "Gold Book") for mercury for the derivation of the BCFs. EPA should provide information on the scientific basis for the derivation of the BCFs used to derive the mercury criteria. The discussion in the Preamble (p. 42179) indicates that there are three different BCFs for fresh water, estuarine waters, and the open ocean. This indicates that it would be most appropriate to calculate separate criteria for each type of water (i.e. fresh, estuarine, and ocean). More to the point, the Preamble also indicates that methylation rates vary widely from one aquatic system to another, thus making it difficult to know the actual potential for bioaccumulation in surface waters in California (p. 42180). Therefore, we believe that for mercury it is necessary for EPA to derive California-specific BCFs for different types of water bodies before adopting human health criteria for mercury in the CTR. At a minimum, separate freshwater and estuarine criteria should be developed. Alternatively, EPA could defer to the State for adoption of appropriate regional or site-specific mercury criteria by RWQCBs using local fish tissue concentration data.

Response to: CTR-059-009

The scientific basis for the range of BCFs is stated in the 1980 ambient water quality criteria document for mercury (Report No. EPA 440/5-80-058), which was part of the CTR Administrative Record Matrix. EPA acknowledges the comment on the differences between types of water bodies (i.e., fresh, estuarine, and ocean) and the Agency is currently evaluating the need to develop separate BAFs for such different water body types. For further response to the bioaccumulation issue, refer to response to CTR-002-007b.

Comment ID: CTR-060-008
Comment Author: San Diego Gas and Electric
Document Type: Electric Utility
State of Origin: CA
Represented Org:
Document Date: 09/26/97
Subject Matter Code: C-01 Mercury
References:
Attachments? N
CROSS REFERENCES

Comment: PROVISIONS SDG&E DOES NOT SUPPORT

As described in the following comments SDG&E does not support the following provisions:

Mercury human health criteria is technically deficient

The mercury human health criterion has used unrealistic assumptions in developing the criterion, including: * the Bioconcentration Factor (BCF) used in calculating the criterion assumes a steady state condition between the mercury concentrations in the water column and fish. The preamble itself acknowledges that there is significant variability in the ratio of water column to fish concentrations (see 62 Fed. Reg. at 42,180, Cols. 1-2). Consequently, EPA should not endorse the use of a single BCF for all California waters. * the BCFs were developed primarily on the basis of species from the Eastern half of the United States and the Atlantic Ocean (e.g., sardines) (See Ambient Water Quality Criteria for Mercury, EPA 440/5-80-058, October 1980) and are not valid for use in the California proposal.

EPA should delay promulgation of a mercury human health criterion until the Science Advisory Board (SAB) Subcommittee comments on EPA's report to congress on mercury

EPA has formed a SAB Subcommittee to comment on its draft Mercury Report to Congress. This Subcommittee is reviewing the fate and transport of mercury which are important factors in developing the mercury human health criterion. EPA should postpone the adoption of the proposed CTR criterion until the final report from this committee is available so that the SAB's findings can be reviewed and incorporated into the CTR criterion.

Response to: CTR-060-008

EPA acknowledges the complexity of issues associated with steady state assumptions when calculating criteria. EPA also believes that it has used appropriate assumptions based on the best methodologies currently in-place. EPA is currently working to enhance its methodology to address these complex issues. Further, once EPA develops the BAF-based human health water quality criteria, EPA will work with the State of California to adopt either that recommended value or a value that is consistent with the final methodology. For additional discussion, refer to responses on CTR-002-007b, CTR-030-007, and CTR-041-004.

Comment ID: CTR-061-012
Comment Author: G. Fred Lee & Associates

Document Type: Academia
State of Origin: CA
Represented Org:
Document Date: 09/25/97
Subject Matter Code: C-01 Mercury
References:
Attachments? Y
CROSS REFERENCES

Comment: Page 42168, third column, first paragraph, states, "The mercury criteria also differ in this proposal due to the Agency's movement away from aquatic life criteria based on the Final Residue Value (FRV) procedure of the 1985 Guidance." It has been learned that the proposed CTR's apparent raising of the Hg criterion for protection from excessive bioaccumulation from the current 12 ng/L to 50 ng/L total mercury is only temporary. The regulation of Hg is under review at the national level. The Agency should have indicated to the regulated community in the proposed CTR that the total Hg criterion for prevention of bioaccumulation will likely decrease from the current 12 ng/L set forth in the "Gold Book" to about 5 ng/L. This revised Hg criterion will cause most domestic wastewater discharges to be in violation of this criterion.

Rather than trying to regulate Hg in wastewater effluents and other sources based on the exceedance of the total Hg criterion to prevent excessive Hg bioaccumulation in edible fish tissue, Hg should be regulated based on excessive Hg concentrations in fish tissue. It is technically invalid to assume, as the US EPA has been assuming and proposes to continue to assume, that there is a constant bioconcentration factor that relates the total concentration of Hg in water to excessive Hg concentrations in fish tissue. The actual bioconcentration of total Hg is highly site-specific. To require that all POTWs and other dischargers or sources of Hg have no more than 5 ng/L in the discharge will grossly over-regulate Hg from many sources.

Response to: CTR-061-012

EPA notes that this response addresses what the commenter believes will be the national criteria recommendations for mercury and human health. EPA disagrees that the proposed criterion for mercury is inappropriate. The Mercury Study Report To Congress has been published and an Agency Mercury Action Plan is being developed. EPA has also begun work to develop a new criterion for mercury that will be based on the Mercury Study Report To Congress and upcoming proposed revisions to the human health methodology. In addition, EPA is evaluating the complexity of determining the BAF and how best to express its value for criteria-setting purposes.

Comment ID: CTR-066-008
Comment Author: Delta Diablo Sanitation Dist.
Document Type: Sewer Authority
State of Origin: CA
Represented Org:
Document Date: 09/26/97
Subject Matter Code: C-01 Mercury
References:
Attachments? N
CROSS REFERENCES

Comment: Our preliminary review of the CTR finds several areas that we believe are positive changes and will enhance the rulemaking. The areas that we support as now written are as follows:

* The revised human health criterion for mercury.

Response to: CTR-066-008

EPA acknowledges the commenter's support of the proposed mercury criterion.

Comment ID: CTR-081-002f
Comment Author: West County Agency
Document Type: Sewer Authority
State of Origin: CA
Represented Org:
Document Date: 09/26/97
Subject Matter Code: C-01 Mercury
References:
Attachments? N
CROSS REFERENCES G-04
C-24a
G-02
C-22
G-09
C-08a
G-05

Comment: * There are many aspects of the CTR that we support. These include: a) Application of interim limits while special studies are perfomed. b) Approach to water effect ratios for determining site specific criteria. c) Inclusion of provision for compliance schedules. However, this should be modified to allow inclusion of compliance schedules of up to 15 years in permits if deemed appropriate by Regional Boards. d) Metals criteria expressed as dissolved rather than total recoverable concentrations. e) EPA's guidance to Regional Boards regarding use of translators. f) EPA's proposal to create a rebuttal presumption for Water Effects Ratios, g) Revised human health criteria for mercury h) Decision to not promulgate human health criteria at this time in light of issues surrounding health criteria for arsenic. i) EPA's policies regarding application of mixing zones and dilution credits.

Response to: CTR-081-002f

EPA acknowledges the commenter's support of the proposed rule.

Comment ID: CTR-085-009
Comment Author: Camarillo Sanitary District
Document Type: Sewer Authority
State of Origin: CA
Represented Org:

Document Date: 09/24/97
Subject Matter Code: C-01 Mercury
References:
Attachments? N
CROSS REFERENCES

Comment: On several aspects of the California Toxics Rule, the District is in agreement with CASA and SCAP comments:

* The revised human health criterion for mercury.

Response to: CTR-085-009

EPA acknowledges the commenter's support of the proposed mercury criterion.

Comment ID: CTR-086-002
Comment Author: EOA, Inc.
Document Type: Trade Org./Assoc.
State of Origin: CA
Represented Org: California Dent
Document Date: 09/26/97
Subject Matter Code: C-01 Mercury
References: Letter CTR-086 incorporates by reference letter CTR-035
Attachments? N
CROSS REFERENCES

Comment: CDA is a strong supporter of water quality and human health protection. CDA's primary goals in commenting on the draft CTR are to request that mercury criteria be based on sound science and that mercury regulation be implemented via a watershed management, phased TNML-type approach.

CDA is particularly concerned that the CTR does not adequately assess the economic impacts on indirect dischargers nor the extent to which there will be measurable water quality benefits solely from adoption of the proposed mercury criteria for point sources.

Mercury Criteria

CDA supports the proposed revised human health criteria for mercury based on updated IRIS information. CDA also supports EPA's decision (p. 42180) not to apply the bioaccumulation factor (BAF) developed for the Great Lakes Initiative to the CTR mercury criteria. We agree that mercury methylation rates vary widely and are not well understood, particularly for amalgamrelated mercury. We believe that adoption of a national BAF under consideration as part of the "Mercury Study Report to Congress: SAB Review Draft" is inappropriate for California, particularly for the complex San Francisco Bay system. CDA recommends that EPA direct the State to develop a site specific objective (SSO) for mercury for San Francisco Bay based on a site specific BAF and data on natural cleanup processes and methylation processes. The proposed CTR criteria should serve as interim criteria until the SSO is developed and adopted.

Response to: CTR-086-002

EPA agrees with the commenter's support of the proposed mercury criterion. EPA encourages the State or Tribe to utilize site-specific information on bioaccumulation when available to calculate criteria. For additional discussion on the complexity of BAF use in the mercury criterion, refer to response on this issue in CTR-041-004.

Comment ID: CTR-089-001b
Comment Author: Las Virgenes Mncpl Water Dist.
Document Type: Sewer Authority
State of Origin: CA
Represented Org:
Document Date: 09/24/97
Subject Matter Code: C-01 Mercury
References:
Attachments? N
CROSS REFERENCES C-22
C-08a
G-05
K-01
G-02
G-09

Comment: The draft California Toxics Rule (CTR) is clearly the product of substantial effort by USEPA staff, and we applaud this effort and its intent. On several issues of concern to public utilities, the CTR strikes a good balance between the need to promulgate standards and the need to base those standards on sound science. Examples include the use of dissolved concentrations rather than the total recoverable concentrations for metals, the deferral of human health criteria for arsenic until adequate information is available, and the revision of the human health criterion for mercury. We are also pleased with the CTR's guidance and flexibility, on mixing zones and dilution credits, total maximum daily loads (TMDLs), compliance schedules, and translators.

Response to: CTR-089-001b

EPA acknowledges the commenter's support of the proposed rule.

Comment ID: CTR-091-001a
Comment Author: Abu-Saba, Ganguli, Flegal
Document Type: Environmental Group
State of Origin: CA
Represented Org: Coastal Advocates
Document Date: 09/25/97
Subject Matter Code: C-01 Mercury
References:
Attachments? N
CROSS REFERENCES

Comment: This comment addresses the mercury criteria for continuous concentration (CCC) proposed in

40 CFR, part 13 1(*1). The proposed aquatic health and human health criteria do not protect aquatic life or humans from mercury contamination. This is demonstrated by the scientific data presented herein. That information includes published and unpublished results from scientists with established reputations in environmental research.

The aquatic life mercury CCC is proposed to be raised sixty-fold, from the National Toxics Rule standard of 0.012 micrograms per liter (ppb) to 0.770 ppb. The human health criteria is proposed to be raised four-fold, from 0.0 12 ppb to 0.050 ppb. These proposed changes have potentially devastating economic and environmental costs that must be included in the EPA's cost-benefit analysis. Water treatment costs for the metals mercury, silver, and chromium account for 30% of costs projected in the, California Toxics Rule (CTR) economic analysis.(*2) However, the long term environmental and economic cost of mercury contamination may far exceed the short term economic savings resulting from an increase in the mercury CCC. This is especially true in California, a mining state that has devoted hundreds of millions of dollars to restoration and enhancement of commercial and sport fisheries by enactment of Proposition 204.

Four specific points are substantiated by data and-literature: (1) California should maintain the National Toxics Rule standard of 0.012 ppb for protection of both aquatic life and human health; (2) The proposed increase in CCC standards do not protect against uncontrolled point-source releases; (3) The proposed criteria of 0.77 ppb (aquatic life) and 0.050 ppb (human health) were derived using assumptions about mercury bioconcentration that are not scientifically justified ; and (4) Wetlands may require even more protective measures than open waterways.

The proposed aquatic life CCC offers no protection from mercury point sources, such as the acid mine drainage shown in Figure 1. The data from San Carlos Creek, above and below the New Idria mercury mine in San Benito County, California, indicate that this mine, which was at one time the second largest producer of mercury in North America(*3), represents an uncontrolled point source mercury release(*4). Acidic water from the abandoned mine mixes with the waters of San Carlos Creek, leading to elevated mercury concentrations below the mine opening.

Figure 2 shows dissolved mercury concentrations upstream and downstream of the mine opening. The existing standard, 0.012 parts per billion (shown by the heavy, black horizontal line), distinguishes between background mercury concentrations (upstream) and point source mercury contamination (downstream). The low concentrations from the two upstream stations reflect natural ambient dissolved mercury concentrations resulting from water drainage through mercury ore deposits in that region(*5). The elevated concentrations downstream of the mine opening clearly exceed the National Toxics Rule mercury criteria. The proposed 0.77 ppb criteria, shown in Figure 3, would not distinguish between natural ambient upstream water and the contaminated water downstream from the mine.

The aquatic life CCC is more than two times greater than concentrations toxic to aquatic life. A water concentration as low as 0.3 ppb inhibits invertebrate reproduction and egg hatching success, and impairs fish physiology(*6). Although the lower human health criteria of 0.05 ppb would apply to essentially all California surface waters(*7), establishment of an aquatic life criteria above toxic effect levels sets a poor precedent for environmental protection.

The New Idria mine is but one example of mercury point source contamination within the State of California; there are many others. Mercury contamination is part of this state's mining legacy(*8). Historically, cinnabar (mercury, sulfide) was mined in California from New ldria, New Almaden, and other mines, and purified to elemental mercury (quicksilver). Thousands of tons of quicksilver were used to amalgamate gold and silver during the late 1800's. It is estimated that 0.3 to 3 kg of mercury was lost,

via volatilization and spillage, for every ton of gold recovered during this period.(*8)

Recent measurements(*9) from California lakes, including Clear Lake, Davis Creek Reservoir, and Lake Nacimiento indicate that dissolved mercury concentrations were twenty to fifty times lower than the proposed human health criteria of 0.05 ppb. However, in each lake largemouth bass contained part per million tissue mercury concentrations which exceeded the National Academy of Sciences guideline for acceptable mercury concentrations in fish.

Part per trillion mercury concentrations in water may be magnified a million-fold, to health-threatening, part per million mercury concentrations in fish. The form of mercury which is most readily bioaccumulated is methylmercury, a form of organic mercury which is produced by bacterial metabolism. Organomercury compounds are highly toxic. Karen Wetterhahn, the prominent Dartmouth researcher who was recently studying mercury toxicity, spilled two drops of dimethylmercury on her hand. Three months later she died from neuralgic damage resulting from acute mercury poisoning(*10) (Figure 5). The disaster in Minimata Bay, Japan, resulted from bacterial conversion of inorganic mercury to methylmercury, and its subsequent bioconcentration.(*11) Birth defects and infant mortality were directly linked to consumption of contaminated fish which had accumulated organomercury.

Methylmercury accumulates in proteins and lipids(*12). So at each subsequent trophic level in a food web, the tissue concentration of mercury increase(*13) . Figure 4 illustrates mercury bioconcentration in a very simple, three-tiered food chain. Methylmercury in water is bioconcentrated by plankton, at the base of the food chain.(*14) Subsequent bioconcentration occurs as plankton are consumed by filter feeders, and again as the filter feeders are consumed by higher level predators. This is a simple food chain example; bioconcentration increases with increasing food web complexity and increasing numbers of trophic levels.

Figure 4 also highlights the importance of mercury in sediments. Sediment-bound mercury can serve as an additional source to filter feeders, as these zones represent the primary location of microbially mediated mercury-methylation in aquatic systems(*15). Wetlands and marshes may be particularly susceptible to mercury pollution. These areas typically have shallow water columns and a large inputs of organic matter to the sediment, which leads to enhanced bacterial activity and subsequently greater mercury-methylation rates(*15). Further, wetlands and marshes provide breeding habitat for diverse populations of fish, birds, and reptiles, and hence, are composed of tightly knit, complex food webs. The susceptibility of these types of environments to mercury pollution has been demonstrated in the Florida Everglades, where low dissolved mercury concentrations result in high concentrations in top level predators, including panthers and sport fish(*16,17,18).

The ratio of the mercury concentration in an organism to the mercury concentration in the organism's ambient water is defined as the bioconcentration factor(*19). Assumptions about the bioconcentration factor are critical to the way the currently proposed human health criteria were derived, because the principle dose of mercury to humans is attributed to contaminated fish. So the appropriate criteria depend on the accepted value of the mercury bioconcentration factor.

Table I compares the bioconcentration factors used in the currently proposed criteria to bioconcentration factors derived from recent research. The practical bioconcentration factor of 7342.6 used in the proposed water quality standards was derived from research that is now almost two decades old. Most mercury data, particularly aqueous dissolved mercury measurements, generated prior to 1988 are suspect. Technological advances in mercury quantification and the establishment of trace metal clean sampling procedures made it possible to accurately measure environmentally relevant mercury concentrations in water(*20,21). The EPA has recently recognized the need for adequate analytical methods and trace

metal clean techniques(*22,23,24). The 1980 bioconcentration factors were derived before trace metal clean techniques for mercury analysis were established. If the dissolved mercury concentration is overestimated due to contamination, the bioconcentration factor will be underestimated.

In the Federal Register discussion of bioconcentration factors, values derived from the Great Lakes Initiative are dismissed, "because it is uncertain whether the bioaccumulation factors of 27,900 and 140,000 are appropriate for use in California at this time..."(*1). However, California field data support bioconcentration factors equal to or greater than those of the Great Lakes Initiative. In 1995, the San Francisco Bay Regional Monitoring program reported tissue concentrations in bivalves that averaged 0.2 ppm. At the same time, aqueous dissolved mercury values ranged from 0.001-0.003 ppb(*25), resulting in a bioconcentration factor between 60,000 and 200,000. In the Gill and Bruland study of mercury in California lakes(*9), tissue and dissolved mercury concentrations lead to a bioconcentration factor between 300,000 and 800,000. Clearly, the bioconcentration factor of 7342.6 used to derive the proposed mercury standard is not appropriate to California.

To summarize, the proposed human health mercury CCC (0.05 ppb) does not sufficiently safeguard human health from mercury contamination. and the proposed aquatic life mercury CCC (0.77 ppb) offers no protection to aquatic life. The aquatic life CCC does not distinguish between contaminated and uncontaminated waters, and is two times higher than published toxic effect levels for mercury(*6). Even though the human health criteria will apply in California(*1,7), the 0.77 ppb criteria for protection of aquatic life sets a dangerous national precedent. In California, mercury concentrations twenty to fifty times lower than the proposed human health criteria lead to elevated concentrations in sport-fish. The aquatic life and human health criteria are based on faulty assumptions about mercury bioconcentration factors in the environment. Using bioconcentration factors appropriate to California would result in much lower mercury water quality criteria.

We ask that Region Nine of the Environmental Protection Agency maintain the established National Toxics Rule standard of 0.012 ppb. Furthermore, we strongly suggest that adequate regulation of mercury consider microbial mercury-methylation potentials and evaluate food web complexity to develop site-specific criteria.

(*1) Water Quality Standards; Establishment of Numeric Criteria for Priority Toxic Pollutants for the State of California; Proposed Rule. U.S. Environmental Protection Agency, Region Nine; U.S. Government Printing Office: Washington D.C., 1997; Federal Register, 62, 42159-42207.

(*2) Mitchel, M. United States Environmental Protection Agency, 1997. Economic analysis presented at hearing for public comment on proposed California Toxics Rule, September 17, 1997, EPA Region Nine offices, San Francisco, California.

(*3) Eckel, E.B.; Myers, W.B. In Report XLII of State Mineralogist; United States Department of the Interior, Geological Survey, 1946. Chapter 2, Quicksilver Deposits of the New ldria District San Benito and Fresno Counties, California.

(*4) Ganguli, P.M.; Abu-Saba, K.E.; Mason, R.P.; Flegal, A.R. 1997. Mercury speciation in San Carlos Creek, San Benito California. Manuscript in preparation.

(*5) Rytuba, J. Environmental geochemistry of mercury in the Coast Range mercury belt, California. Abstract in 1997 International Society of Environmental Geochemistry meeting, Oct. 5-10, Vale CO.

(*6) Eisler, R. 1987. Mercury hazards to fish, wildlife and invertebrates: a synoptic review. U.S. Fish and Wildlife Service, Research and Development Biological report 85- 1.10.

(*7) Wood, P. United States Environmental Protection Agency. Personal communication at hearing for public comment on proposed California Toxics Rule, September 17, 1997, EPA Region Nine offices, San Francisco, California.

(*8) Nriagu. J.O.; Wong, H.K.T. In Mercury and its Effects on Environment and biology; Sigel, A. ; Sigel H. Eds.; Metal Ions in Biological Systems. Vol. 34; Dekker: New York, 1997. Chapter 5, Gold Rushes and Mercury Pollution.

(*9) Gill G.; Bruland KW, 1990. Mercury speciation in surface freshwater systems in California and other areas. Environ. Sci. Technol 24: 1392-1400

(*10) Time, 149, June 23, 1997, p. 29

(*11) Harada, M. 1995. Minimata disease: methylmercury poisoning in Japan caused by environmental pollution. Critical Reviews in Toxicology, 1997, 25, 1-24.

(*12) Huffman, D.L.; Utschig, L.M.; O'Halloran, T.V. In Mercury and its Effects on Environment and Biology; Sigel, A, ; Sigel H. Eds.; Metal Ions in Biological Systems. Vol. 34- Dekker: New York, 1997. Chapter 18, Mercury-Responsive Gene Regulation and Mercury- 199 as a Probe of Protein Structure.

(*13) Boudou, A.; Ribeyre, F. In Mercury and its Effects on Environment and Biology; Sigel, A.; Sigel H. Eds.; Metal Ions in Biological Systems. Vol. 34; Dekker: New York, 1997. Chapter 10, Mercury in the Food Web: Accumulation and Transfer Mechanisms.

(*14) Mason, R.P.; Reinfelder, J.R.; Morel, F.M.M.. Uptake, toxicity, and trophic transfer of mercury in a coastal diatom. Environ. Sci. TechnoL 1996, 30, 1835.

(*15) Baldi F. In Mercury and its Effects on Environment and Biology; Sigel, A. ; Sigel H. Eds.; Metal Ions in Biological Systems. Vol. 34; Dekker: New York, 1997. Chapter 8, Bacterial Transformation of Mercury Species and Their Importance in the Biogeochemical Cycle of Mercury.

(*16) Ware F.; Royals H.; Lange T. Mercury contamination in Florida Largemouth Bass.Proc. Amer. Conf. Southeast Assoc. Fish Wildl. Agen. 1990, 44, 5-12.

(*17) Roelke M.; Schultz D.; Facemire C.; Sundlof S.; Royals H. Mercury contamination in Florida panthers. Gainsville, FL, Florida Game and Freshwater Fish Commission report, 1991.

(*18) Sundlof S.R.; Spalding M.G.; Wentworth J.D.; Steible C.K. Mercury in livers of wading birds (Ciconiiformes) in Southern Florida. Arch. Environ. Contam. Toxicol. 1994, 27, 299-305.

(*19) Meili M. In Mercury and its Effects on Environment and Biology; Sigel, A. ; Sigel H. Eds.; Metal Ions in Biological Systems. Vol. 34; Dekker: New York, 1997. Chapter 2, Mercury in Lakes and Rivers.

(*20) Bloom N.S.; Fitzgerald W.F., Determination of volatile mercury species at the picogram level by low temperature gas chromatography with cold-vapor fluorescence detection. Analytica Chimica Acta. 1988, 208, 151-161.

(*21) Bloom N. S. Determination of picogram levels of methylmercury by aqueous phase ethylation, followed by cryogenic gas chromatography with cold-vapor atomic fluorescence detection. Can. J. Fish. Aquat. Sci. 1989, 46, 1131-1140.

(*22) Guidance on the Documentation and Evaluation of Trace Metals Data Collected for Clean Water Act Compliance Monitoring. U. S. Environmental Protection Agency, Office of Water, Engineering and Analysis Division; U.S. Government Printing Office: Washington, D.C., 1995; EPA-821-B-95-002.

(*23) Method 1631: Mercury in Water by Oxidation, Purge and Trap, and Cold Vapor Atomic Fluorescence Spectrometry. U.S. Environmental Protection Agency, Office of Water; U.S. Government Printing Office: Washington, D.C., 1995; EPA-821-R-95-027.

(*24) Method 1669: Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Levels. U.S. Environmental Protection Agency, Office of Water; U. S. Government Printing Office: Washington, D.C., 1995; EPA-821-R-95-034.

(*25) Regional Monitoring Program 1995 Annual Report; San Francisco Estuary Institute: Richmond, California.

Response to: CTR-091-001a

Regarding the protectiveness of the mercury criteria, refer to responses in CTR-029-002b, CTR-030-007 and CTR-051-003a. EPA recognizes the significance of the accumulation of toxic chemicals, particularly bioaccumulatives, in our nation's sediments. For this reason, EPA is in the process of developing "Equilibrium Partitioning Sediment Guidelines" for use in identifying contaminated sediments which are potentially toxic to benthic organisms. These chemical guidelines are calculated based on the organic carbon content of the sediment for nonionic organic chemicals and acid volatile sulfide content for divalent cationic metals. At this time, EPA has developed guidance for the calculation of bioaccumulation factors (BAFs) for a variety of chemicals. The BAFs are used to ensure that protective levels of water column contaminants are established. BAFs are based on the freely dissolved concentration of the bioaccumulative chemical, such as mercury. The use of BAFs, particularly those calculated based on field data, will provide a mechanism to address the accumulation of chemicals in organisms at higher trophic levels in the food web. For further discussion, refer to the response to CTR-002-007b.

EPA is also currently working to enhance its methodology to address the complex BAF issues. Further, once EPA develops the BAF-based human health water quality criteria, EPA will work with the State of California to adopt either that recommended value or a value that is consistent with the final methodology. By 2003, EPA will promulgate revised criteria for California for mercury based on a BAF for the protection of human health. As part of this process, EPA will evaluate all available published information, including data originating in California.

Comment ID: CTR-091-001b
Comment Author: Abu-Saba, Ganguli, Flegal
Document Type: Environmental Group
State of Origin: CA
Represented Org: Coastal Advocates

Document Date: 09/25/97
Subject Matter Code: C-01 Mercury
References:
Attachments? N
CROSS REFERENCES

Comment: This comment addresses the mercury criteria for continuous concentration (CCC) proposed in 40 CFR, part 13 1(*1). The proposed aquatic health and human health criteria do not protect aquatic life or humans from mercury contamination. This is demonstrated by the scientific data presented herein. That information includes published and unpublished results from scientists with established reputations in environmental research.

The aquatic life mercury CCC is proposed to be raised sixty-fold, from the National Toxics Rule standard of 0.012 micrograms per liter (ppb) to 0.770 ppb. The human health criteria is proposed to be raised four-fold, from 0.0 12 ppb to 0.050 ppb. These proposed changes have potentially devastating economic and environmental costs that must be included in the EPA's cost-benefit analysis. Water treatment costs for the metals mercury, silver, and chromium account for 30% of costs projected in the, California Toxics Rule (CTR) economic analysis.(*2) However, the long term environmental and economic cost of mercury contamination may far exceed the short term economic savings resulting from an increase in the mercury CCC. This is especially true in California, a mining state that has devoted hundreds of millions of dollars to restoration and enhancement of commercial and sport fisheries by enactment of Proposition 204.

Four specific points are substantiated by data and-literature: (1) California should maintain the National Toxics Rule standard of 0.012 ppb for protection of both aquatic life and human health; (2) The proposed increase in CCC standards do not protect against uncontrolled point-source releases; (3) The proposed criteria of 0.77 ppb (aquatic life) and 0.050 ppb (human health) were derived using assumptions about mercury bioconcentration that are not scientifically justified ; and (4) Wetlands may require even more protective measures than open waterways.

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Figure 2 shows dissolved mercury concentrations upstream and downstream of the mine opening. The existing standard, 0.012 parts per billion (shown by the heavy, black horizontal line), distinguishes between background mercury concentrations (upstream) and point source mercury contamination (downstream). The low concentrations from the two upstream stations reflect natural ambient dissolved mercury concentrations resulting from water drainage through mercury ore deposits in that region(*5). The elevated concentrations downstream of the mine opening clearly exceed the National Toxics Rule mercury criteria. The proposed 0.77 ppb criteria, shown in Figure 3, would not distinguish between natural ambient upstream water and the contaminated water downstream from the mine.

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California surface waters(*7), establishment of an aquatic life criteria above toxic effect levels sets a poor precedent for environmental protection.

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Recent measurements(*9) from California lakes, including Clear Lake, Davis Creek Reservoir, and Lake Nacimiento indicate that dissolved mercury concentrations were twenty to fifty times lower than the proposed human health criteria of 0.05 ppb. However, in each lake largemouth bass contained part per million tissue mercury concentrations which exceeded the National Academy of Sciences guideline for acceptable mercury concentrations in fish.

Part per trillion mercury concentrations in water may be magnified a million-fold, to health-threatening, part per million mercury concentrations in fish. The form of mercury which is most readily bioaccumulated is methylmercury, a form of organic mercury which is produced by bacterial metabolism. Organomercury compounds are highly toxic. Karen Wetterhahn, the prominent Dartmouth researcher who was recently studying mercury toxicity, spilled two drops of dimethylmercury on her hand. Three months later she died from neuralgic damage resulting from acute mercury poisoning(*10) (Figure 5). The disaster in Minimata Bay, Japan, resulted from bacterial conversion of inorganic mercury to methylmercury, and its subsequent bioconcentration.(*11) Birth defects and infant mortality were directly linked to consumption of contaminated fish which had accumulated organomercury.

Methylmercury accumulates in proteins and lipids(*12). So at each subsequent trophic level in a food web, the tissue concentration of mercury increase(*13) . Figure 4 illustrates mercury bioconcentration in a very simple, three-tiered food chain. Methylmercury in water is bioconcentrated by plankton, at the base of the food chain.(*14) Subsequent bioconcentration occurs as plankton are consumed by filter feeders, and again as the filter feeders are consumed by higher level predators. This is a simple food chain example; bioconcentration increases with increasing food web complexity and increasing numbers of trophic levels.

Figure 4 also highlights the importance of mercury in sediments. Sediment-bound mercury can serve as an additional source to filter feeders, as these zones represent the primary location of microbially mediated mercury-methylation in aquatic systems(*15). Wetlands and marshes may be particularly susceptible to mercury pollution. These areas typically have shallow water columns and a large inputs of organic matter to the sediment, which leads to enhanced bacterial activity and subsequently greater mercury-methylation rates(*15). Further, wetlands and marshes provide breeding habitat for diverse populations of fish, birds, and reptiles, and hence, are composed of tightly knit, complex food webs. The susceptibility of these types of environments to mercury pollution has been demonstrated in the Florida Everglades, where low dissolved mercury concentrations result in high concentrations in top level predators, including panthers and sport fish(*16,17,18).

The ratio of the mercury concentration in an organism to the mercury concentration in the organism's ambient water is defined as the bioconcentration factor(*19). Assumptions about the bioconcentration factor are critical to the way the currently proposed human health criteria were derived, because the principle dose of mercury to humans is attributed to contaminated fish. So the appropriate criteria depend on the accepted value of the mercury bioconcentration factor.

Table I compares the bioconcentration factors used in the currently proposed criteria to bioconcentration factors derived from recent research. The practical bioconcentration factor of 7342.6 used in the proposed water quality standards was derived from research that is now almost two decades old. Most mercury data, particularly aqueous dissolved mercury measurements, generated prior to 1988 are suspect. Technological advances in mercury quantification and the establishment of trace metal clean sampling procedures made it possible to accurately measure environmentally relevant mercury concentrations in water(*20,21). The EPA has recently recognized the need for adequate analytical methods and trace metal clean techniques(*22,23,24). The 1980 bioconcentration factors were derived before trace metal clean techniques for mercury analysis were established. If the dissolved mercury concentration is overestimated due to contamination, the bioconcentration factor will be underestimated.

In the Federal Register discussion of bioconcentration factors, values derived from the Great Lakes Initiative are dismissed, "because it is uncertain whether the bioaccumulation factors of 27,900 and 140,000 are appropriate for use in California at this time..."(*1). However, California field data support bioconcentration factors equal to or greater than those of the Great Lakes Initiative. In 1995, the San Francisco Bay Regional Monitoring program reported tissue concentrations in bivalves that averaged 0.2 ppm. At the same time, aqueous dissolved mercury values ranged from 0.001-0.003 ppb(*25), resulting in a bioconcentration factor between 60,000 and 200,000. In the Gill and Bruland study of mercury in California lakes(*9), tissue and dissolved mercury concentrations lead to a bioconcentration factor between 300,000 and 800,000. Clearly, the bioconcentration factor of 7342.6 used to derive the proposed mercury standard is not appropriate to California.

To summarize, the proposed human health mercury CCC (0.05 ppb) does not sufficiently safeguard human health from mercury contamination. and the proposed aquatic life mercury CCC (0.77 ppb) offers no protection to aquatic life. The aquatic life CCC does not distinguish between contaminated and uncontaminated waters, and is two times higher than published toxic effect levels for mercury(*6). Even though the human health criteria will apply in California(*1,7), the 0.77 ppb criteria for protection of aquatic life sets a dangerous national precedent. In California, mercury concentrations twenty to fifty times lower than the proposed human health criteria lead to elevated concentrations in sport-fish. The aquatic life and human health criteria are based on faulty assumptions about mercury bioconcentration factors in the environment. Using bioconcentration factors appropriate to California would result in much lower mercury water quality criteria.

We ask that Region Nine of the Environmental Protection Agency maintain the established National Toxics Rule standard of 0.012 ppb. Furthermore, we strongly suggest that adequate regulation of mercury consider microbial mercury-methylation potentials and evaluate food web complexity to develop site-specific criteria.

(*1) Water Quality Standards; Establishment of Numeric Criteria for Priority Toxic Pollutants for the State of California; Proposed Rule. U.S. Environmental Protection Agency, Region Nine; U.S. Government Printing Office: Washington D.C., 1997; Federal Register, 62, 42159-42207.

(*2) Mitchel, M. United States Environmental Protection Agency, 1997. Economic analysis presented at hearing for public comment on proposed California Toxics Rule, September 17, 1997, EPA Region Nine offices, San Francisco, California.

(*3) Eckel, E.B.; Myers, W.B. In Report XLII of State Mineralogist; United States Department of the

Interior, Geological Survey, 1946. Chapter 2, Quicksilver Deposits of the New ldria District San Benito and Fresno Counties, California.

(*4) Ganguli, P.M.; Abu-Saba, K.E.; Mason, R.P.; Flegal, A.R. 1997. Mercury speciation in San Carlos Creek, San Benito California. Manuscript in preparation.

(*5) Rytuba, J. Environmental geochemistry of mercury in the Coast Range mercury belt, California. Abstract in 1997 International Society of Environmental Geochemistry meeting, Oct. 5-10, Vale CO.

(*6) Eisler, R. 1987. Mercury hazards to fish, wildlife and invertebrates: a synoptic review. U.S. Fish and Wildlife Service, Research and Development Biological report 85- 1.10.

(*7) Wood, P. United States Environmental Protection Agency. Personal communication at hearing for public comment on proposed California Toxics Rule, September 17, 1997, EPA Region Nine offices, San Francisco, California.

(*8) Nriagu. J.O.; Wong, H.K.T. In Mercury and its Effects on Environment and biology; Sigel, A. ; Sigel H. Eds.; Metal Ions in Biological Systems. Vol. 34; Dekker: New York, 1997. Chapter 5, Gold Rushes and Mercury Pollution.

(*9) Gill G.; Bruland KW, 1990. Mercury speciation in surface freshwater systems in California and other areas. Environ. Sci. Technol 24: 1392-1400

(*10) Time, 149, June 23, 1997, p. 29

(*11) Harada, M. 1995. Minimata disease: methylmercury poisoning in Japan caused by environmental pollution. Critical Reviews in Toxicology, 1997, 25, 1-24.

(*12) Huffman, D.L.; Utschig, L.M.; O'Halloran, T.V. In Mercury and its Effects on Environment and Biology; Sigel, A, ; Sigel H. Eds.; Metal Ions in Biological Systems. Vol. 34- Dekker: New York, 1997. Chapter 18, Mercury-Responsive Gene Regulation and Mercury- 199 as a Probe of Protein Structure.

(*13) Boudou, A.; Ribeyre, F. In Mercury and its Effects on Environment and Biology; Sigel, A.; Sigel H. Eds.; Metal Ions in Biological Systems. Vol. 34; Dekker: New York, 1997. Chapter 10, Mercury in the Food Web: Accumulation and Transfer Mechanisms.

(*14) Mason, R.P.; Reinfelder, J.R.; Morel, F.M.M.. Uptake, toxicity, and trophic transfer of mercury in a coastal diatom. Environ. Sci. TechnoL 1996, 30, 1835.

(*15) Baldi F. In Mercury and its Effects on Environment and Biology; Sigel, A. ; Sigel H. Eds.; Metal Ions in Biological Systems. Vol. 34; Dekker: New York, 1997. Chapter 8, Bacterial Transformation of Mercury Species and Their Importance in the Biogeochemical Cycle of Mercury.

(*16) Ware F.; Royals H.; Lange T. Mercury contamination in Florida Largemouth Bass.Proc. Amer. Conf. Southeast Assoc. Fish Wildl. Agen. 1990, 44, 5-12.

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(Ciconiiformes) in Southern Florida. Arch. Environ. Contam. Toxicol. 1994, 27, 299-305.

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(*20) Bloom N.S.; Fitzgerald W.F., Determination of volatile mercury species at the picogram level by low temperature gas chromatography with cold-vapor fluorescence detection. Analytica Chimica Acta. 1988, 208, 151-161.

(*21) Bloom N. S. Determination of picogram levels of methylmercury by aqueous phase ethylation, followed by cryogenic gas chromatography with cold-vapor atomic fluorescence detection. Can. J. Fish. Aquat. Sci. 1989, 46, 1131-1140.

(*22) Guidance on the Documentation and Evaluation of Trace Metals Data Collected for Clean Water Act Compliance Monitoring. U. S. Environmental Protection Agency, Office of Water, Engineering and Analysis Division; U.S. Government Printing Office: Washington, D.C., 1995; EPA-821-B-95-002.

(*23) Method 1631: Mercury in Water by Oxidation, Purge and Trap, and Cold Vapor Atomic Fluorescence Spectrometry. U.S. Environmental Protection Agency, Office of Water; U.S. Government Printing Office: Washington, D.C., 1995; EPA-821-R-95-027.

(*24) Method 1669: Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Levels. U.S. Environmental Protection Agency, Office of Water; U. S. Government Printing Office: Washington, D.C., 1995; EPA-821-R-95-034.

(*25) Regional Monitoring Program 1995 Annual Report; San Francisco Estuary Institute: Richmond, California.

Response to: CTR-091-001b

EPA will address this concern as part of its mercury re-assessment -- as it relates to bioaccumulation. See responses to CTR-002-007b and CTR-091-001a.

Comment ID: CTR-095-002a
Comment Author: M. Ruth Uiswander
Document Type: Citizen
State of Origin: CA
Represented Org:
Document Date: 10/02/97
Subject Matter Code: C-01 Mercury
References:
Attachments? N
CROSS REFERENCES

Comment: Also, the rules pertaining to mercury, fail to take into account the bioaccumulation of mercury in fish tissue. Studies done in the Gr. Lakes show that bioaccumulation is 4 to 20 times greater than what the EPA estimates for California.

Response to: CTR-095-002a

Regarding the issue on mercury bioaccumulation, refer to the response to CTR-002-007b.

Comment ID: CTR-095-002b
Comment Author: M. Ruth Uiswander
Document Type: Citizen
State of Origin: CA
Represented Org:
Document Date: 10/02/97
Subject Matter Code: C-01 Mercury
References:
Attachments? N
CROSS REFERENCES

Comment: Also, the rules pertaining to mercury, fail to take into account the bioaccumulation of mercury in fish tissue. Studies done in the Gr. Lakes show that bioaccumulation is 4 to 20 times greater than what the EPA estimates for California.

Response to: CTR-095-002b

See response to CTR-002-007b.

Comment ID: CTR-104-002a
Comment Author: Lucy Nelson, et. al.
Document Type: Citizen
State of Origin: CA
Represented Org:
Document Date: 10/15/97
Subject Matter Code: C-01 Mercury
References:
Attachments? N
CROSS REFERENCES C-14

Comment: Proposed mercury standards fail to account for bioaccumulation of mercury in fish tissue. Mercury is amassed through their consumption of food.

Response to: CTR-104-002a

Regarding the issue on mercury bioaccumulation, refer to the response to CTR-002-007b.

Comment ID: CTR-106-002a
Comment Author: Robert Brown
Document Type: Citizen
State of Origin: CA

Represented Org:
Document Date: 10/28/97
Subject Matter Code: C-01 Mercury
References:
Attachments? N
CROSS REFERENCES C-14

Comment: Proposed mercury standards fail to account for bioaccumulation of mercury in fish tissue. Mercury is amassed through their consumption of food.

Response to: CTR-106-002a

Regarding the issue on mercury bioaccumulation, refer to the response to CTR-002-007b.

Comment ID: CTR-109-002a
Comment Author: Maggie Miller
Document Type: Citizen
State of Origin: CA
Represented Org:
Document Date: 12/01/97
Subject Matter Code: C-01 Mercury
References:
Attachments? N
CROSS REFERENCES C-14

Comment: Second, the proposed mercury standards fall to account for the bioaccumulation of mercury in fish tissue. The proposed standard ignores mercury that enters fish through their own consumption of food.

Response to: CTR-109-002a

Regarding the issue on mercury bioaccumulation, refer to the response to CTR-002-007b.

Comment ID: CTRH-001-003c
Comment Author: Robert Hale
Document Type: Public Hearing
State of Origin: CA
Represented Org: CA Stormwater Task Force
Document Date: 09/17/97
Subject Matter Code: C-01 Mercury
References:
Attachments? N
CROSS REFERENCES C-22
C-24a

Comment: In summing up -- not summing up, just as a parting shot -- I do appreciate the fact that in

working up the toxics rule here that EPA has done certain things which in fact we see as improvements in actually making the standards fit with what we think -- have come to see as perhaps the actual impacts of the stormwater part of this. And by that, I'm referring to the dissolved metals criteria and the water effect ratio in there, and the human health criteria revisions for mercury and the other -- the other items.

I appreciate some of the stuff in there, and -- with the exception of the preamble language. And you really need to get that out of there. We're going to pursue this as far as we have to.

I appreciate your hearing me.

Response to: CTRH-001-003c

EPA acknowledges the comments made and their support of the rule.

Comment ID: CTRH-001-013
Comment Author: Greg Karras
Document Type: Public Hearing
State of Origin: CA
Represented Org: Comm. for Better Environ.
Document Date: 09/17/97
Subject Matter Code: C-01 Mercury
References:
Attachments? N
CROSS REFERENCES

Comment: Issues on mercury:

Bay fisherpeople report eating more mercury-tainted fish than the state says is safe for developmental neurotoxicity. EPA proposes a weaker standard that allows these mercury pollution levels in the vast majority of the bay rather than reducing this harm.

EPA says it has itself weakened the standard because EPA doesn't know whether mercury bioaccumulates here as much as it bioaccumulates in the Great Lakes. San Francisco Bay data show that it does. Will EPA use these data?

Response to: CTRH-001-013

The commenter is incorrect regarding the proposed standard for the San Francisco Bay. The previous standard of 0.025 ug/L will remain in effect for the San Francisco Bay. The commenter is also incorrect about EPA's position regarding bioaccumulation. EPA did not suggest that it did not know if mercury bioaccumulated as much in the Bay as in the Great Lakes. Rather, EPA stated that the Great Lakes data were not appropriate for use in the Bay. EPA is evaluating available bioaccumulation data to determine its appropriateness for use in California. EPA is also currently working to enhance its methodology to address these complex issues. Further, once EPA develops the BAF-based human health water quality criteria, EPA will work with the State of California to adopt either that recommended value or a value that is consistent with the final methodology. Within the next several years, EPA or the State will promulgate revised criteria for California for mercury based on a BAF for the protection of human health. For additional discussion on mercury bioaccumulation, refer to the response to CTR-002-007b.

Comment ID: CTRH-001-018a
Comment Author: Khalil Abu-Saba
Document Type: Public Hearing
State of Origin: CA
Represented Org: UCSC
Document Date: 09/17/97
Subject Matter Code: C-01 Mercury
References:
Attachments? N
CROSS REFERENCES

Comment: MR. ABU-SABA: Good afternoon. My name is Khalil Abu-Saba. I'm a graduate student in chemistry at the University of California, Santa Cruz. I want to thank Kathleen Van Velsor of Coastal Advocates for having me here to speak today.

Today we'd like to address mercury criteria for continuous concentration as proposed in the California Toxics Rule. The facts I'll be presenting today come from the interpretations of a number of scientists of established reputation in environmental research. In the written transcript of this speech, there are 20 references giving the names of those authors, who reviewed this presentation before I submitted it.

The mercury criteria for continuous concentration is proposed to be raised from the National Toxics Rule standard of 0.012 parts per billion up to 0.770 parts per billion. That is a 60-fold increase in the mercury criteria. We will present the facts showing that allowing that level of mercury in fresh water has potentially devastating economic and environmental consequences.

We will show why mercury regulation should consider particulate as well as dissolved concentrations and why wetlands may require even more protective measures than open waterways.

Finally, we will demonstrate how the proposed standard was derived using assumptions about mercury bioconcentration that are scientifically unsound.

First, let's compare the current National Toxics Rule standard to mercury concentrations downstream from a point source. The preliminary measurements for this stream were provided by Priya Ganguli and Russ Flegal of University of California Santa Cruz and Rob Mason of the Chesapeake Bay Laboratory of the University of Maryland.

The data come from San Carlos Creek, above and below the New Idria mercury mine in San Benito County. This mine, which was at one time the second largest producer of mercury in North America, represents an uncontrolled point source mercury release.

Acidic water from the abandoned mine mixes with the waters of San Carlos Creek, leading to elevated mercury concentrations below the mine opening. The brown water you see in this slide is from metals precipitated after the acid mine drainage mixes with the clear water of San Carlos Creek.

The next graph we'll be showing you will be the part-per-billion concentrations of filtered mercury above and below the mine opening. These are filtered mercury concentrations consistent with the promulgated standard.

The point of this graph is that the existing standard, 0.012 parts per billion, shown by the heavy, black horizontal line, distinguishes between background regional processes and point source contamination. The two lowest mercury concentrations on the left are from water samples upstream of the mine opening in clear water; those concentrations represent mercury concentrations in water which could result naturally from drainage of mercury ore deposits in that region.

The concentrations downstream of the mine opening, in the brown water you just saw, clearly exceed the current National Toxics Rule standard of .012 parts per billion. In contrast, if we were to put the proposed continuous criteria concentration standard on the same scale with this graph, that standard would be two stories above our heads right now.

The next graph shows the same mercury concentrations from New ldria on scale with the proposed criteria of 0.77 parts per billion. Clearly, the proposed criteria does not distinguish between background processes and point source contamination. Mercury levels in the clear water and in the brown water are equal in the eyes of the proposed criteria.

That is the economic benefit that will be derived from raising limits on mercury in water. The citizens of California will be asked to ignore point source contamination of mercury. This is one example from within the State of California; there are many others.

Mercury contamination is part of our mining legacy in this state, we ignore it at our peril. In a 1990 publication in Environmental Science and Technology, Gary Gill and Ken Bruland show that Clear Lake, Davis Creek Reservoir, and Lake Nacimiento all had filtered mercury concentrations that were several hundred times lower than the 0.77 parts per billion proposed standard. Those lakes also had largemouth bass with part-per-million tissue mercury concentrations exceeding the National Academy of Sciences guideline for acceptable mercury concentrations in fish.

How are subpart-per-billion mercury concentrations in water magnified a million-fold to health-threatening part-per-million mercury concentrations in fish? To understand this, we have to recognize that not all mercury is created equal.

This is cinnabar or mercury sulfide. This is an example of inorganic mercury. This type of ore was mined in California at the New Idria and New Almaden mines, and roasted to make elemental mercury or quicksilver, which we're familiar with in the tip of a common thermometer.

Thousands of tons of elemental mercury were used to extract gold during the Gold Rush, distributing mercury throughout California. In the environment, bacterial action can convert inorganic mercury into organic mercury compounds, including methylmercury. The toxicity of mercury depends on its chemical form.

I didn't bring any organic mercury in today; it is too toxic to safely handle in public. I did bring in the obituary of Karen Wetterhahn. As most of you know, she was a prominent Dartmouth researcher who was studying mercury toxicity. This year, she spilled two drops of dimethylmercury on her hand. Three months later, she was dead from neurological damage resulting from acute mercury poisoning.

The disaster in Minimata Bay, Japan, resulted from bacterial conversion of inorganic mercury to methylmercury, and its subsequent bioconcentration.

Methylmercury accumulates in proteins, so at each level in a complex food web the tissue concentration

of mercury increases. This graph shows an example of mercury bioconcentration in a very simple, three-tiered food chain.

Methylmercury in water is bioconcentrated by plankton at the base of the food chain. Subsequent bioconcentration occurs as plankton are consumed by filter feeders, and again as the filter feeders are consumed by higher level predators. This is a simple food chain example; bioconcentration increases with increasing food web complexity.

This figure also highlights the importance of mercury in sediments. Sediment-bound mercury can serve as an additional source to filter feeders. Moreover, conversion of inorganic mercury to methylmercury is regulated by bacteria.

Extensive bacterial methylation occurs in sediments, which host bacterial communities. Wetlands and marshes are much more sensitive areas because intense bacterial activity leads to greater methylation rates, and because they have complex food webs.

This has already been demonstrated in the Florida Everglades, where relatively low dissolved mercury concentrations result in high concentrations in top-level predators, including panthers and sport fish.

Deriving a criteria for dissolved mercury alone and ignoring particulate mercury concentrations, bacterial metabolism, and ecosystem structure is inadequate to protecting the health of California citizens.

The magnification of mercury in water to tissue mercury can be qualified by a value referred to as bioconcentration factor. Assumptions about the bioconcentration factor are critical to the way the proposed criteria was derived because the primary source of mercury to humans is attributed to contaminated fish. So the appropriate criteria, depends on what we accept as a reasonable value for the mercury bioconcentration factor.

The bioconcentration factor of mercury is simply defined as the ratio of the mercury concentration in an organism to the mercury concentration in the organism's surrounding waters, just tissue mercury over water mercury.

In the justification of the proposed criteria, this table compares the bioconcentration factors used in the proposed criteria to bioconcentration factors developed from more recent research. The bioconcentration factor of 7,300 as used in the proposed criteria was derived from research now almost two decades old.

All mercury data and in particular water measurements generated prior to 1988 are suspect. The methods published in 1988 by Bloom and Fitzgerald, and the establishment of trace metal clean sampling procedures to avoid contamination made it possible to measure environmentally relevant concentrations of mercury in water.

The EPA has recognized in their own publications the need for adequate analytical methods and trace metal clean techniques. This is EPA method 1631, mercury in water by cold vapor atomic fluorescence spectrometry, April 1995. This is EPA method 1669, sampling ambient water for EPA water criteria levels. This method 1669 describes how to avoid contamination in trace metal analysis.

The 1980 bioconcentration factors used to derive the proposed criteria come from data generated before trace metal clean techniques were established. If you overestimate the water mercury concentration due to contamination, you will underestimate the bioconcentration factor, because the dissolved concentration appears here in the denominator.

In the Federal Register discussion of the bioconcentration factors, values derived from the Great Lakes initiative are dismissed, "because it is uncertain whether the bioaccumulation factors of 28,000 and 140,000 are appropriate for use in California at this time." That's a quote from the Federal Register.

We can compare the relevance of these bioconcentration factors by examining field data from California, as Greg Karras suggested. In 1995, the San Francisco Bay regional monitoring program reported tissue concentrations in bivalves that averaged 0.2 parts per million.

At the same time, quantifiable dissolved mercury values ranged from 0.001 to 0.003 parts per billion. If you just plug those numbers into the formula for bioconcentration factor, you get a bioconcentration factor between 60,000 and 200,000.

In the Gill and Bruland study of mercury in California lakes, tissue and dissolved mercury concentrations lead to a bioaccumulation factor between 300,000 and 800,000. Clearly, the bioconcentration factor of 7,300 used to derive the proposed standard is not appropriate to California.

To summarize, the proposed mercury standard of 0.77 parts per billion does not distinguish between contaminated and uncontaminated waters. The proposed standard is based on faulty assumptions about mercury bioconcentration in the environment.

The potential economic costs of this legislation far exceed any perceived benefits from ignoring mercury contamination. For example, one of the goals of Proposition 204 is the protection and enhancement of commercial and sport fishing in the State of California. To that end, hundreds of millions of dollars have been committed to water quality improvement and habitat restoration. A 60-fold increase in the permissible mercury limits can only hinder these goals.

We ask that Region 9 of the Environmental Protection Agency promulgating the California Toxics Rule maintain the established National Toxics Rule standard of 0.012 parts per billion. Furthermore, we strongly suggest that adequate regulation of mercury should incorporate particulate mercury concentrations and should consider the potential for bacterial activity and evaluate ecosystem complexity to develop site-specific criteria.

Response to: CTRH-001-018a

See response to CTR-002-007b.

Comment ID: CTRH-001-018b
Comment Author: Khalil Abu-Saba
Document Type: Public Hearing
State of Origin: CA
Represented Org: UCSC
Document Date: 09/17/97
Subject Matter Code: C-01 Mercury
References:
Attachments? N
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Deriving a criteria for dissolved mercury alone and ignoring particulate mercury concentrations, bacterial metabolism, and ecosystem structure is inadequate to protecting the health of California citizens.

The magnification of mercury in water to tissue mercury can be qualified by a value referred to as bioconcentration factor. Assumptions about the bioconcentration factor are critical to the way the proposed criteria was derived because the primary source of mercury to humans is attributed to contaminated fish. So the appropriate criteria, depends on what we accept as a reasonable value for the mercury bioconcentration factor.

The bioconcentration factor of mercury is simply defined as the ratio of the mercury concentration in an organism to the mercury concentration in the organism's surrounding waters, just tissue mercury over water mercury.

In the justification of the proposed criteria, this table compares the bioconcentration factors used in the proposed criteria to bioconcentration factors developed from more recent research. The bioconcentration factor of 7,300 as used in the proposed criteria was derived from research now almost two decades old.

All mercury data and in particular water measurements generated prior to 1988 are suspect. The methods published in 1988 by Bloom and Fitzgerald, and the establishment of trace metal clean sampling procedures to avoid contamination made it possible to measure environmentally relevant concentrations of mercury in water.

The EPA has recognized in their own publications the need for adequate analytical methods and trace metal clean techniques. This is EPA method 1631, mercury in water by cold vapor atomic fluorescence spectrometry, April 1995. This is EPA method 1669, sampling ambient water for EPA water criteria levels. This method 1669 describes how to avoid contamination in trace metal analysis.

The 1980 bioconcentration factors used to derive the proposed criteria come from data generated before trace metal clean techniques were established. If you overestimate the water mercury concentration due to contamination, you will underestimate the bioconcentration factor, because the dissolved concentration appears here in the denominator.

In the Federal Register discussion of the bioconcentration factors, values derived from the Great Lakes initiative are dismissed, "because it is uncertain whether the bioaccumulation factors of 28,000 and 140,000 are appropriate for use in California at this time." That's a quote from the Federal Register.

We can compare the relevance of these bioconcentration factors by examining field data from California, as Greg Karras suggested. In 1995, the San Francisco Bay regional monitoring program reported tissue concentrations in bivalves that averaged 0.2 parts per million.

At the same time, quantifiable dissolved mercury values ranged from 0.001 to 0.003 parts per billion. If you just plug those numbers into the formula for bioconcentration factor, you get a bioconcentration factor between 60,000 and 200,000.

In the Gill and Bruland study of mercury in California lakes, tissue and dissolved mercury concentrations

lead to a bioaccumulation factor between 300,000 and 800,000. Clearly, the bioconcentration factor of 7,300 used to derive the proposed standard is not appropriate to California.

To summarize, the proposed mercury standard of 0.77 parts per billion does not distinguish between contaminated and uncontaminated waters. The proposed standard is based on faulty assumptions about mercury bioconcentration in the environment.

The potential economic costs of this legislation far exceed any perceived benefits from ignoring mercury contamination. For example, one of the goals of Proposition 204 is the protection and enhancement of commercial and sport fishing in the State of California. To that end, hundreds of millions of dollars have been committed to water quality improvement and habitat restoration. A 60-fold increase in the permissible mercury limits can only hinder these goals.

We ask that Region 9 of the Environmental Protection Agency promulgating the California Toxics Rule maintain the established National Toxics Rule standard of 0.012 parts per billion. Furthermore, we strongly suggest that adequate regulation of mercury should incorporate particulate mercury concentrations and should consider the potential for bacterial activity and evaluate ecosystem complexity to develop site-specific criteria.

Response to: CTRH-001-018b

See response to CTR-002-007b.

Comment ID: CTRH-001-050a
Comment Author: Michael Lozeau
Document Type: Public Hearing
State of Origin: CA
Represented Org: S.F. Bay/Delta Keeper
Document Date: 09/17/97
Subject Matter Code: C-01 Mercury
References:
Attachments? N
CROSS REFERENCES C-14

Comment: For mercury, certainly I would concur with the previous comments, that the number should be -- that is appropriate is accumulation factors.

Now the bioconcentration factor, in deference to this state's consumption rates that have been determined are appropriate for California, I think using the average consumption rate for everyone in the country, by definition, lops off about half of the population. It seems to me that it doesn't account for those users of the bay who are the high consumption -- high fish-consumption users, which obviously there's a number of them, and that's not reflected in that average at all.

So I think that those bioaccumulation factors are important to the mercury number base data that we have for the bay for all the reasons stated earlier, and similarly for dioxin. It seems as if EPA would like to back away on that, the criteria that is listed.

Response to: CTRH-001-050a

Regarding the comments on mercury human health toxicity, see responses to CTR-006-002a and CTR-030-007. Regarding mercury bioaccumulation, see response to CTR-002-007b.

Comment ID: CTRH-001-062
Comment Author: Fred Lee
Document Type: Public Hearing
State of Origin: CA
Represented Org:
Document Date: 09/17/97
Subject Matter Code: C-01 Mercury
References:
Attachments? N
CROSS REFERENCES

Comment: The other point I want to make, we had a discussion about mercury today and that discussion doesn't address the issues properly. That discussion focused on the number -- I think it was .77 parts per billion, and that's not a human health criteria. That is the toxicity part. That's a dissolved mercury. As related to aquatic life, that number's about right.

Response to: CTRH-001-062

EPA acknowledges the comment.

Comment ID: CTRH-001-063
Comment Author: Fred Lee
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Comment: In another part of the Federal Register promulgating the rule, there is a statement about -- for human health, the number is proposed to be 50 nanograms per liter -- going from 12 nanograms per liter, now the current gold book number, to 50 under these criteria. But if you go further and you ask what does that mean really? Do I think mercury is less toxic? No way.

What it's headed for is that within two to six months to a year, as state and federal rules on mercury are developed through the Science Advisory Board review, so forth, it's a pretty good chance that's going to drop, 3 to 5.

You should understand we're headed for 3 to 5 nanograms per liter for total mercury as a number to protect from excessive bioaccumulation. That's where we're headed.

I'll stop at this point.

Response to: CTRH-001-063

Regarding the comments on mercury human health toxicity, see responses to CTR-006-002a and CTR-030-007. Regarding mercury bioaccumulation, see response to CTR-002-007b.

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